July 1968

IMPERIAL OIL REVIEW

Rare

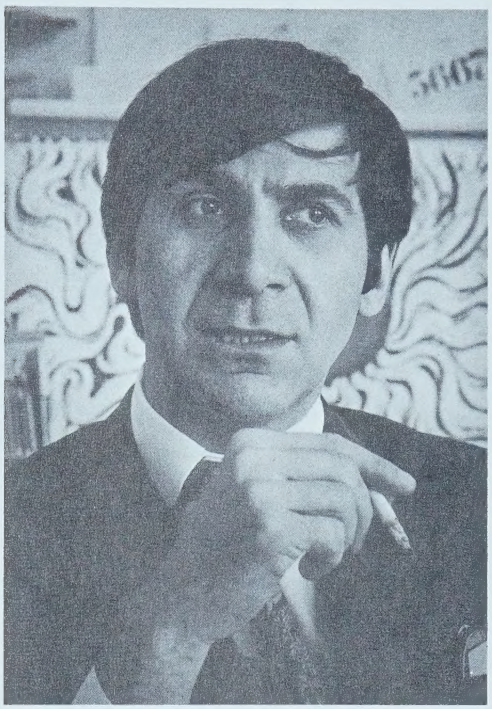
To every place there is a season, a time above all times that is best of all. In Paris, the time is April; in England, it's June; for a trip to Florida it's February or March. For Canada the best time of all is July.

July is the prime month, robust and virile after the mad young growth of May and June, high summer with no frosts, the only month it's safe to count chickens before they're hatched. Thoughts of winter are impossible in July; spring, however fickle it may have been, is past; and August, when the blazing sun browns the grass in premonition, is yet to come.

School has just let out and Labor Day is unimaginably distant. There are festivals and fairs, picnics, trips, holidays and long, lazy days subsiding slowly into evenings calm and quiet, and velvet nights with blankets. The exuberant flowers of spring are gone, the peonies, and irises, cherry blossoms, tulips, daffodils and lilacs, and in their place July's garden shines in spires of larkspur and hollyhocks, in lyric annuals singing their colors to the sun. Blues and pinks and butter yellows, marigolds and daisies, pansies and petunias, and summer roses red as blood. July is all glory, gold and pink and perfect coast to coast.

Nothing closes in July but the trumpet of the morning glory, and that only to give place to another, fresher bell. The doors are open, and the windows; the cottage is open, and all the attractions for the tireless tourist, and every roadside stand that spent the winter shuttered against the snow. Apple juice. Homemade pies. Dew worms. Fresh-laid eggs. Raspberries, 300 yards. Buy them now, for they will never taste so sweet again. And savor July, for no other month is so clearly meant for Canada. □

Review in Review



Carlos Marchiori

Artist

The sun that shines so refulgently on this month's cover is the last piece of work Carlos Marchiori delivered before catching a plane for a holiday in Mexico and thence to an extended stay in Japan. That's rather appropriate, for the first piece of design he sold in Canada when he came here 11 years ago from Italy was also a cover for the Review–a motorized Santa Claus that appeared in December, 1957. In between, he did another cover, a psychedelic Santa Claus, for December, 1965.

Marchiori is somewhat psychedelic himself. The day he dropped off the sun he came in wearing white trousers, a purple jacket, and a flowing, electric-blue tie. He looked the way an artist is expected to look, and a colorful sight he was.

His trip to Japan is his second. He visited that country for about a year in 1964 and 1965; long enough to learn a little Japanese, do a little work, and start a big love affair with the whole far-eastern thing. It shows up in the design for this month's cover–that sun is two-faced. The face on the right is gentle; the face on the left, stern and forbidding. In Marchiori's (and the oriental) view, the sun is both good and bad; it warms your back, but it can also give you a nasty sunburn. Thus it embodies the oriental principle of yang and yin, a dualistic philosophy that sees both good and bad in everything. Yang is the good side, bright, happy and construed as male. Yin is dark, evil, melancholy, and female. Put them both together and you can make a sun like Carlos Marchiori's, or a symbol that looks this 

Mistake

Contrary to what it said in the May issue of the Imperial Oil Review, the U.S. gallon does *not* work out to almost exactly four-fifths of the Imperial gallon. It works out to almost exactly five-sixths, as a chastening number of readers pointed out as soon as the issue was in their hands. Indeed, as the article states, a barrel of oil contains 34.97 Imperial gallons, which is 42 U.S. gallons, which is a ratio of 5 to 6. A U.S. gallon is also 231 cu. in. while the Imperial gallon is 277.42 cu. in.–a ratio of 5 to 6. In metric measure, the U.S. gallon equals 3.7853 liters; the Imperial gallon, 4.5460 liters–a ratio of 5 to 6.

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For a generation Les Hodge towed his customers' cars free, looked at their children's throats, rescued their womenfolk, and even lent them money

Your friendliest possible neighborhood Esso dealer

by Fred Annesley

Why in the world would a woman drive 45 miles from Hamilton just to get her car serviced at a little service station in Toronto? Why would a man call the owner of the same little station from another station across town to say his car's run out of gas and would he please hurry over with some? The answer is this: They were addicted to the charm of a happy little man called Les Hodge.

For 22 years Les Hodge operated an Esso station in a crowded old residential area of Toronto at Vaughan Road and Alameda Avenue. He owned the station–a rare thing in a metropolitan area where land costs are high and most stations are company-owned and operated by a lessee-dealer–until he sold it to another Esso dealer this year. When he decided to sell the station he was actually afraid to tell some of his customers. A lot of them are women and Les doesn't like emotional scenes. But he had to sell.

Two years ago a stroke knocked his whole right side out of action. It took away his speech and he's had to learn to talk all over again. He's still confined to a wheelchair in his suburban Willowdale home but he's confident that he will be able to walk eventually, and he still radiates the good humor that made his station a very unusual place.

Les, the son of a Toronto service station owner, pumped gas and tinkered with cars for a total of 43 years, and he's only 54 now. He started as a schoolboy helping out at his father's station on Parliament Street. After World War II he took over the funny looking little station on Vaughan Road.

That station was Hodge's very own, and he ran it the way he pleased. And the way he ran it pleased a lot of people.

It might not seem that way at first glance. What's a customer to think about a service station operator who's been known to force a woman driver out of her car to stand in the pouring rain? What kind of an operator would put regular gas in the tank of a car when the customer demanded premium, and let the customer drive away thinking he'd bought premium? How about a man who takes in your car for repairs and then won't let you have it back–just refuses to give it to you–until you get some additional repairs done?

Les Hodge has done these things and Les Hodge had a lot of customers who never dreamed of doing business anywhere else.

'Some people are too serious,' he laughs. 'This one fellow used to come in with a big car and he always got premium. So this day he comes in and just as I go to put in the gas I realize I'm right out of premium. So I put in regular. When I told him he nearly hit the roof. He comes in for gas the next time, and wouldn't you know it, I'd just run out of premium again. So this time I put in regular again and never let on. He never knew.' He chuckles.

The lady in the rain? Well, Les loves people but he believes downright thoughtless people ought to be taught a lesson once in a while. This lady came in one day and it was pouring rain and she had Les check the oil and the water and the tires. When the sopping Les got through all this he suggested he should complete the service by

checking her battery. No, never mind the battery, she said. But Les insisted, because he knew the battery on that particular car was under the driver's seat. So the poor woman had to get out while Les took his own sweet time checking her battery.

'Everybody's nice, though,' says Les. 'Everybody's nice. I mean that. Maybe some of them act a little funny sometimes, but you know what I find? I find it's just because there's something bothering them and if you can find out what it is they stop acting funny and you find they're nice people.'

Les used to go to even greater lengths to save his customers from the consequences of their own actions. Say a young man left a car in for tune-up and Les found the brakes were worn. He wouldn't give the car back. He would tell the boy he had to have those brakes fixed. If the boy objected Les would phone his parents–he knew the faces and families of most of the people in the area–and explain that their son wanted to drive a dangerous car. If it was just money holding up the brake job Les would always take the money later.

'I bet you I never lost more than $20 in all the time I was there,' says Les of his haphazard credit arrangements.

That may be a little surprising to anyone with less faith in people than Les Hodge had because his credit arrangements included lending money, $10 here and $20 there, to *strangers*. His wife, Ella, sitting across the room just smiles and shakes her head in recollection. She explains that it wasn't always easy living with a man who loves people as much as Les Hodge.

'Yes, well you know,' says Les. 'The odd time a young fellow would pull in with a scowl on his face and I didn't like to see that. I'd find out that he was out of work and worrying about his family or something and I'd give him some money. Then he'd stop looking bad like that, you know?'

Hodge's business arrangements were just as unorthodox. One side of his business never made a nickel–his towing service.

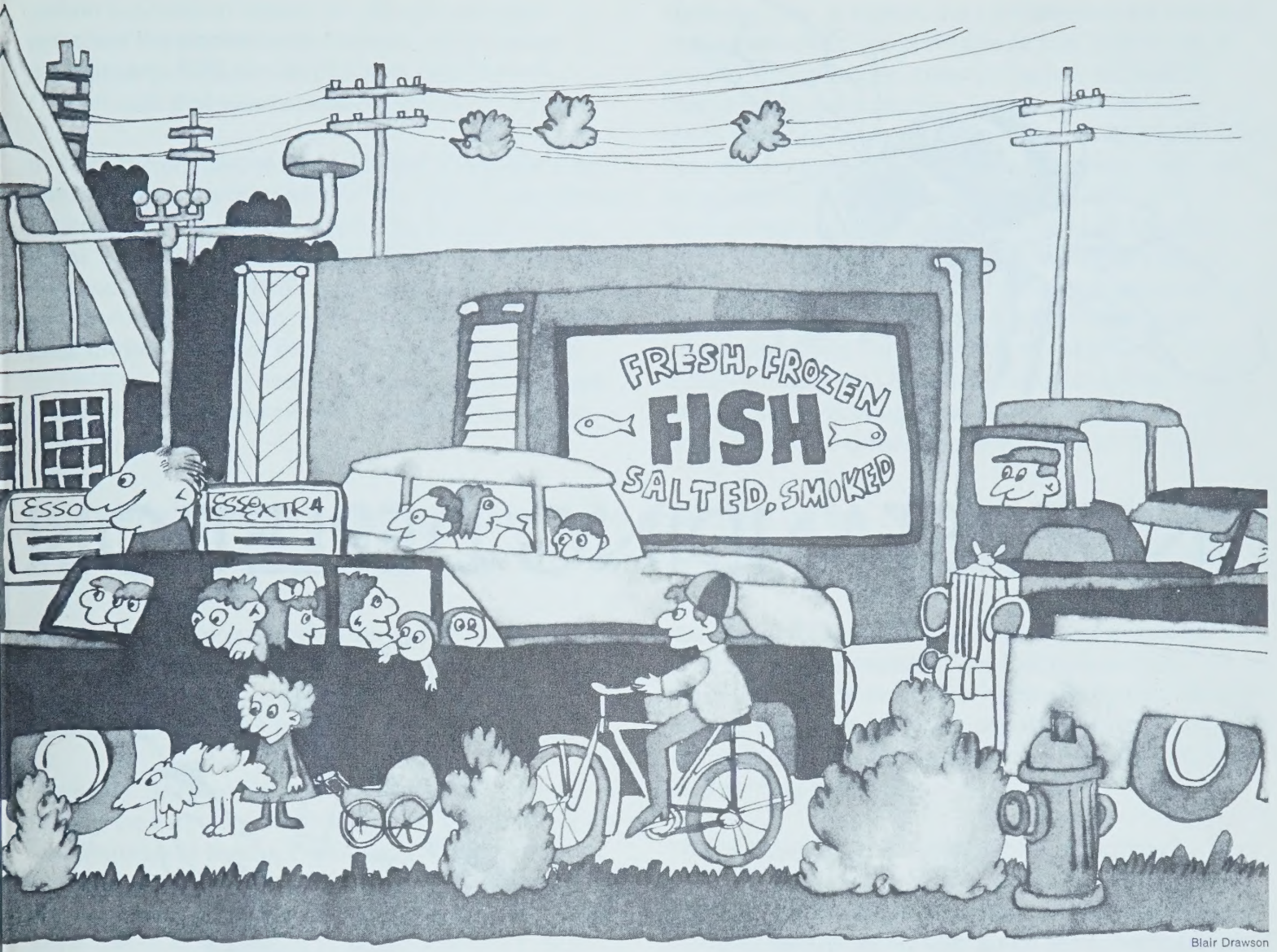
'I never once charged for a tow. If a man's car got in trouble I went and got it and that was that.'

He never charged for a lot of little services and that's how he got his faithful Hamilton customer. Eighteen years ago, when the lady lived in the Vaughan Road-Alameda area, she put her car in her garage at a very tricky angle and couldn't get it out. So she went over to the little Esso station in desperation. Les got the car out unscathed and for free. She was a customer ever after, although even Les admits that driving in from Hamilton for service is stretching loyalty a bit.

Women have accounted for a good bit of Les Hodge's business because the station is close to Vaughan Road Collegiate and the lady teachers came to him for gasoline. And the ladies with their cars found in Les Hodge the answer to a woman driver's prayer: a service station man who could be trusted to fix the silly thing right and change the oil and rotate the tires or whatever it is they do with cars.

The ladies trusted Les completely. Once he even got bawled out by a teacher for having the nerve to ask if she wanted an unsafe wheel fixed.

'She tore into me, I tell you it was terrible,' says Les. 'She told me never to ask her a thing like that again. She said it was my job to keep



Blair Drawson

her car in good condition and I was to go ahead and do what had to be done and not bother her. Boy, was she mad.'

Les Hodge inspired such confidence in the women of the neighborhood that they trusted him with matters far more serious than cars. Sometimes he answered calls to come and look at their sick children and decide if a doctor should be called. He has answered calls from ladies who locked themselves out of their houses and wanted Les to break in for them. 'Well, they all knew me and when they needed a man to do something they'd call me,' he explains. 'I didn't mind. In fact, I loved it.

'I went to work whistling every morning. I can't explain how I felt about that place but I just loved my work. Just loved it.'

At the beginning it wasn't easy with post-war gasoline rationing still in effect, and Les made very little money. During that rationing period though, he absolutely refused to grant favors to anyone who didn't have gasoline coupons. He believes he got some of his most loyal customers through his unswerving policy of honesty in the rationing period.

He worked from dawn until dark at the beginning and often came home at night so tired he couldn't eat his dinner. 'But I loved it,' he says. 'I loved working. Even when we'd have an argument at home I'd head off to the station and in no time I'd be my happy old self again.'

He lowered his voice and leaned forward over the table. 'Listen, you think a service station doesn't make money? Listen, those fellows who complain about not making money out of a station are crazy. Listen, if a man can get through the first year in a service station he's going to make money. And I mean a good living.'

Les got through his first year all right and when he began to feel sure of himself he cut down his working day. 'I only worked from eight to seven after things got going,' he says. He did that six days a week and went for 18 years without a holiday.

'I know all about a man's supposed to take a holiday. But I'd get so sad on a holiday when I was away from the station. I didn't know what to do with myself.'

On February 28, 1966, his wife, who once again had failed to talk him into taking a holiday, had Les drive her out to the airport so she, at least, could catch some Florida sun. When she waved good-by to Les that day she waved good-by to the way of life she had grown accustomed to with her husband. Les went back to the station and that same day was felled by the stroke. His wife flew back immediately to find him paralyzed in hospital.

Les has made a strong recovery and is still making progress. He's confined to the wheelchair but he's not depressed. He's catching up on all the reading he didn't have time for before. For the last two years his brother, Jack, and his son, Bob, have kept the station going. It was sold last winter because, said Les, 'Jack needs a rest and he doesn't need the money.' Bob, who Les describes as a great mechanic, is 30 and wants to look around a bit.

Last winter Les went to Florida with his wife. 'They're nice people down there,' he says. 'Of course all people are nice once you get to know them. They are, really.' □

UNDERSTANDING DEPLETION

Illustrations: Ed Nakamura

How you feel about things like tax incentives and bumblebees may reflect your basic attitudes

When you come right down to it, the controversy over the depletion allowance is like the disagreement between the practical man and the theorist. If a thing doesn't work, the practical man fixes it; when it does work, he leaves it alone. For the theorist, it doesn't matter whether it works or not; what's important to him is whether it conforms to principle. The practical man is delighted by the bumblebee; the theorist is outraged–principle says the bumblebee can't fly.

The depletion allowance is a creation of practical men that is being attacked by theorists on the grounds that it violates the principle of tax neutrality.
Neutrality wasn't particularly on Finance Minister Sir Thomas White's mind when, on Feb. 15, 1916, he proposed a tax on business profits to help finance World War I. It was a pretty modest tax: 'We propose to impose taxation to the extent of one fourth of the amount of net profits upon capital derived since the outbreak of the war in excess of . . . seven per cent.'

A practical man, his act took into consideration the fact that a resource in the ground becomes exhausted as it is produced. The next year, when Parliament passed a general tax act, the Income War Tax Act of 1917, its section 3(1)(a) permitted a taxpayer to deduct 'such reasonable allowance as may be allowed by the minister for depreciation, or for any expenditure of a capital nature for renewals, or for the development of a business, and the minister, when determining the income derived from mining and from oil and gas wells, shall make an allowance for the exhaustion of mines and wells.'

And so, for the next 29 years, the amount of the depletion allowance was left to the discretion of the minister responsible for collecting taxes. For most of that time the depletion allowance for the petroleum industry was 25 per cent–that is, an oil company paid tax on three quarters of its profit (although 'profit' was an arbitrary amount–no deduction was allowed for

certain exploration costs). In 1941 the minister exercised his discretion to increase the depletion allowance to 33⅓ per cent for oil wells west of Ontario, and that was his last discretionary move.

In 1946 the amount of the depletion allowance was removed from the discretion of the finance minister and established by order in council. The allowance was set at '33⅓ per cent of the net profits from the production and sale of oil' for oil wells located west of Ontario, and the Income Tax Act of 1948 continued the allowance under Part XII of the Income Tax Regulations. In 1949 the 33⅓ per cent allowance was made applicable to both gas and oil wells, wherever they were located in Canada.

Last year's Carter report proposed the abolition of this 52-year-old incentive to a strong Canadian oil industry, and controversy has surrounded it ever since

In short, they tinkered with it somewhat, but the depletion allowance has been available for 51 years. Obviously, successive governments must have believed it was useful to the country.

(Actually, there are several depletion allowances; among them the dividend depletion allowance which shareholders of some oil, gas and mining companies may deduct from their dividend incomes when they are computing their income tax; the cost depletion allowance, which is applicable to timber limits and certain industrial minerals like clay, gravel and limestone, and which recovers capital costs over the lifetime of mineral production; and the percentage depletion allowance which is based on profits and applies to minerals like copper and nickel as well as oil and gas. The one we're concerned with here–and the one that has received all the attention lately–is the percentage depletion allowance. The depletion figures sometimes shown in annual reports refer to still another allowance, one much closer to a form of depreciation in its effect.)

But why is there a depletion allowance anyway? Calgary tax expert A. Gordon Burton (writing at the request of the Carter Commission on taxation) stated in study number 12 *Comments re Taxation of the Oil and Gas Industry:* 'In the final analysis we must come to the conclusion that the only reason for depletion is one of incentive to persuade people to risk their money.'

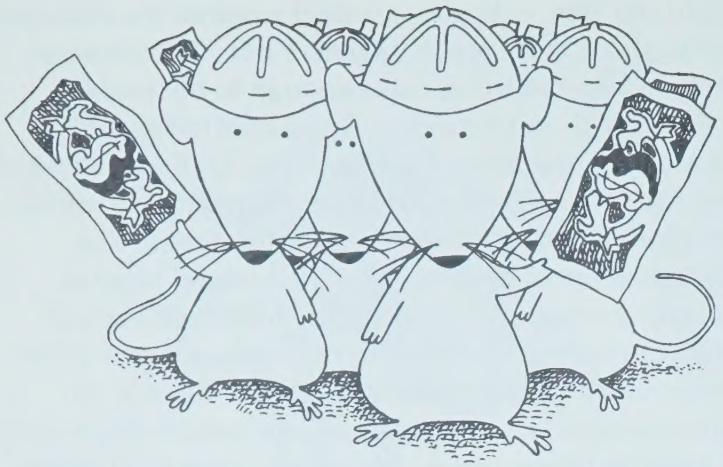
Of course, that's what tax incentives are usually for. The tax structure is filled with various kinds of incentives and subsidies. The difference between them is, basically, this: subsidies are paid whether the industries that receive them are profitable or not; incentives go only to industries that make enough to be taxable. The railroads get subsidies. So do coal mines and many farm operators. Tax incentives, on the other hand, are used for such purposes as encouraging industries to adopt practices to control water pollution. The development of new mines is encouraged by a tax incentive–they pay no tax for the first three years of their operation. The depletion allowance is one of the most efficient incentives ever devised–there is no allowance unless the explorer is successful and ends in a position where he has a taxable income from which his depletion allowance can be deducted. If he fails, he pays no taxes and receives no allowance. It's rather like a footrace with 10 men entered and a prize of $100. If all the contestants are told they will each receive $10 at the finish line, none will try very hard to be first. But if only the winner gets the prize, every man will do his best and the sponsors will have a better race at no added cost.

The next question, naturally, is: has it worked?

Well, if Canada were a laboratory, and oil men were white mice, it might be possible to answer that question unequivocally, because you could set up an experiment that would offer the allowance to half the mice and see how they did in relation to those who were denied it. Suitable controls would have to be included, of course, and it might be necessary to switch the teams around to even out differences of temperament. Unfortunately for those who like clean answers to hard questions, this can't be done, although taking the incentive into account there is little doubt which team would do better.

In 1966 Canada's oil industry produced $944 million worth of oil, natural gas and by-product sulphur. Some 629 million acres were being explored. Canada's liquid hydrocarbon reserves have increased a hundredfold since the major discovery at Leduc in 1947. Production of oil has increased 50 times. It seems unlikely that this record would have been attained *without* the depletion allowance.

In any event, the depletion allowance has been a part of the Canadian oil industry's investment situation for more than half a century, and capital has already been



If oilmen were white mice, answers would be easy

committed to investments made on the understanding that the allowance will continue. To break faith and remove it now would, in effect, result in retroactive taxation–a most unfair practice.

Finding useful oil wells is probably the chanciest undertaking in all industry–of the 8,121 new field wildcat wells (that is, wells located where oil had not previously been discovered) drilled in Canada between 1947 and 1962, only 597 (or 7.4 per cent) actually proved capable of production. In no other line of endeavor is the businessman gambling against 10-to-1 odds that he'll find the raw material he needs for production. In every other business (except mining and fishing) he can obtain his raw materials on the open market.

One of the functions of the depletion allowance is to coax people into risking their money in the face of such odds.

But any mention of depletion in Canada often seems to conjure up visions of Texas millionaires with broadloom in the garage and Cadillacs on the broadloom, and very little income tax to pay. In the United States, it is possible to achieve this state through the provisions of the American depletion allowance regulations. They allow any U.S. taxpayer (individual or corporate) who owns an oil or gas property to (1) exclude from taxable income 27.5 per cent of the *gross* revenue each year, but this allowance must not exceed 50 per cent of the taxable income from each property; and (2) deduct currently from income much of the outlay for exploration, drilling and development, plus all operating costs such as wages and salaries. (Incidentally, one aspect of the American practice–that of basing depletion on the gross revenue from a property–is more logical than the Canadian practice, which bases depletion on the net. Gross revenue represents the value of the capital that is being used up, and depletion should be a charge on this).

But to get back to the millionaires: in Canada it is not possible for an individual taxpayer to get into the exploration business and charge his expenses off against his other income, the way an American pop singer or football player who has had a good year can do. Even if he goes into partnership with other businessmen, an individual Canadian must report his gains or losses from oil or gas separately from the results of his other business. As a result, you find few–if any–oil millionaires of the Texas type in Canada.

The U.S. tax incentives that encourage American oil seekers apply to them wherever they may be operating in the world, including Canada. Therefore, a U.S. company exploring here enjoys a more favorable depletion allowance and, for this reason alone, it would be against Canadian interests to reduce or remove any tax incentive that encourages exploration by Canadian companies.

In fact, wouldn't such a move constitute a violation of the beautiful principle of tax neutrality? Answer: yes.

A neutral tax, simply stated, is a tax that has no effect on the allocation of resources. In a world where taxes were neutral and perfect competition for investment money existed, capital would go where it was most useful. Where tax neutrality does not exist, the theory has it, resources are deflected to take advantage of the provisions of the tax. Can't argue with that.

But has the depletion allowance caused capital to be invested in less useful enterprises? Tax expert Richard A. Musgrave, a professor of economics at the Harvard Law School, doesn't think so. Writing in the *Canadian Tax Journal* for July-August, 1967, he states: 'The efficiency gains from the removal of depletion are difficult to assess, because it cannot be assumed that the capital which is withdrawn from such investment will in fact be transferred to other Canadian industries. But without such transfer, the efficiency result will be negative, unless the investment was considered a liability to the Canadian economy.'

Now, nobody pretends that the Canadian petroleum industry was made possible by the depletion allowance, but it is fair to say that this tax incentive was an encouraging factor. The industry has spent something like $8.5 billion in exploration and production since 1946. It has earned this country almost a billion dollars

a year in imports of oil avoided, and in revenue from oil and gas exports. A practical man, looking at this level of return, could scarcely conclude that the investment was a liability.

As for taxes in general, it seems that one of the results of the press discussion that followed the publication of the Carter report last year was the impression that, as a result of the depletion allowance, the petroleum industry is only lightly taxed. It isn't. In fact, the petroleum industry must make payments to governments which do not apply to other manufacturers.

Some of them aren't called taxes–they are called royalties, rentals, lease bonus payments, 'fees' and taxes on production volume–but most of the revenue they represent goes to the provincial governments, with a smaller part going to Ottawa.

These payments to governments regularly run around $300 million a year–in 1965 they were $313,612,000; in 1966 they totalled $300,085,000. The total revenue the oil industry contributed to provincial governments between 1957 and 1966 amounts to more than $2½ billion, not including the amount collected by the various road taxes.

At the same time, the petroleum industry has to pay the taxes any other business has to pay. It is difficult to be precise about the amounts these taxes represent, because the Dominion Bureau of Statistics and the department of national revenue often lump the petroleum industry in among the coal mines and stone quarries. But a fairly good guess would put the total taxes paid by all facets of the petroleum industry in 1966 alone at around $265 million, broken down this way: $138 million in federal sales tax; $8 million in import duties; $47 million in municipal taxes; and $72 million in corporate income tax. (It must be remembered that, taken as a whole, the producing portion of the Canadian oil industry has spent almost $2 billion more than it has earned and many companies are not in a position to pay taxes. When they start making money, their income taxes will go up.) In addition, the oil industry generated for the provincial governments nearly $734 million in diesel fuel and gasoline taxes in fiscal 1966. Competing forms of energy are either subsidized directly, like coal, or untaxed, like hydro-electric utilities. Nuclear power is both subsidized (government will build the plants) and untaxed.

Finding oil is a gamble against 10-to-1 odds

There's one more thing to keep in mind: taxes come to be regarded as part of the cost of doing business. The market determines the price, but in a broad sense if the tax is cut, prices can be expected to drop; if the tax goes up, so will prices.

With all that said, it is possible to make a couple of comments about the depletion allowance. The first is that the existence of the allowance has, to a degree, enabled provincial governments to levy alternative taxes under the guise of licences, fees and royalties. If the Canadian depletion allowance didn't exist, the Canadian oil companies would not be able to pay the high prices now prevailing for leases; as a result, the best leases would go to those who could afford them–that is, to foreign oil companies operating with a competitive edge because their own governments provide an incentive in the form of a depletion allowance. Furthermore, the amounts bid would likely drop and, since most oil play is on Crown lands, the ultimate loser would be the provincial governments.

The second comment to be made about the removal of the depletion allowance (whether here, in the United States, or wherever) is that it would simply raise the operating costs of oil companies.

In other words, the depletion allowance keeps costs down. And that's something on whose value both the practical man and the theorist can agree. □

Size

By itself it's meaningless but apply it to big projects and it gets big results

The Coast Mountains form a spectacular setting for Imperial's Ioco refinery, the biggest in British Columbia

Fuel lift (top) flies diesel oil from Imperial's Arctic supply dump at Resolute to Mould Bay, even farther north

Drilling camps in northwestern Alberta (above) have opened the Rainbow wilderness in their search for oil

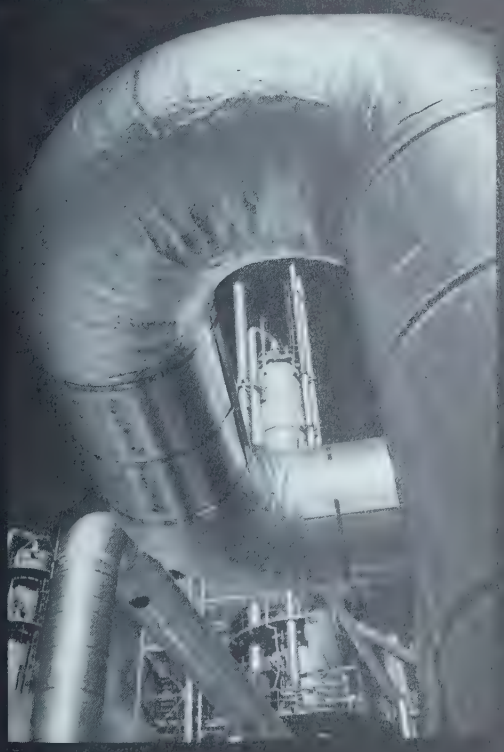
Photos: Imperial Oil Ltd.

Imperial Oil is the biggest oil company in Canada. But it's in more than oil. Imperial is in chemicals, fertilizers, minerals, plastics, car care, pipe lines, oil tankers, building materials –even baler twine. Some of these may look like strange things for an oil company to be engaged in, but there is a strong link between each of them and Imperial's principal business–the finding, producing, transporting, refining and marketing of oil and petroleum products.

And that, by itself, is why the oil industry and the companies in it have got to be big. This is one industry that demands size–only large-scale enterprise could persist to discover and develop Canada's petroleum resources, build its enormously long transportation and supply lines, construct and maintain its necessarily vast refineries, and support its essential and expensive research.

Imperial's size has enabled the company not only to keep growing in oil, but to extend itself into related endeavors. Its vigorous expansion makes Imperial the kind of company that attracts not only skillful and able employees, but the capital with which they can work to maintain a growth that is important not only to Imperial Oil but to Canada too. Twice in the last 19 months Imperial has issued debentures in the amount of $50 million each, and both issues were over-subscribed–they were sold out before they went on sale. Big resources in men and money are essential when entirely new industries are being developed, as Imperial is doing with the fertilizer manufacturing plants under construction by a force of more than 350 men in Alberta. Only a very big company can count on such resources. A big company is also in a better position to take advantage of the economies of mass production where the manufacture of products in very large quantities or volumes helps to keep the price of individual items low.

In the fiercely competitive oil business such economies are essential, and Imperial's size makes them possible. The company markets one sixth of Canada's energy requirements (more than the output of all the hydro-electric plants in the country), and produces about 14 per cent of all the country's oil. In 1967 Im-



Sulphur-recovery apparatus at Winnipeg refinery (above) extracts 2,000 tons of sulphur annually from refinery gases

The 820,000-barrel tanker Imperial Ottawa *(top) dwarfs 42,448-barrel* Imperial Halifax *at Dartmouth refinery*

As high-rises replace homes, Imperial-pioneered automotive service centers replace former corner service stations

perial produced 141,000 net barrels of crude oil and natural gas liquids per day–a total of 51,539,000 barrels for the year. 'Net' means the total production, after royalty amounts–usually expressed in barrels–are deducted.

Imperial had to buy additional Canadian crude oil to meet its manufacturing and export requirements. In 1967 those purchases reached 210,000 barrels per day. An additional 130,000 barrels a day of foreign crude oil were imported for markets east of the Ottawa valley. On the other hand, in 1967 Imperial exported western crude to the United States amounting to 131,000 barrels a day. That was the first year that Imperial's exports of crude oil exceeded its imports. The total amount of crude oil processed by Imperial's refineries in 1967 was 350,000 barrels a day, nearly a third of all the crude oil processed by all Canadian refineries last year.

In addition, Imperial produced 334 million gross cu. ft. of natural gas a day in 1967, or roughly eight per cent of the Canadian total.

Imperial geologists are constantly seeking new sources of oil and gas in one of the largest exploration programs in Canada, ranging from ocean drilling on the Grand Banks off Newfoundland to seismic surveys of the frozen plains of the Arctic.

The cost of this exploration to Imperial in 1967 was just over $36 million. The company spent another $40 million acquiring proven acreages, developing oil and gas fields, lifting the crude to the surface, and on waterfloods and other methods to increase oil recovery. This $76 million total was the largest single part of Canada's total oil exploration and production spending of $894 million in 1967, and was $17 million more than the total spent by any other company. Money, money, money perhaps, but it's a convenient way to indicate the size of Imperial's operations.

In spite of all its exploration activity, Imperial's proved remaining reserves of crude oil went down from 1,534 million barrels to 1,517 million in 1967, although Canada's total reserves increased by a small amount. But total Canadian production increased a little faster than total reserves, so that proved reserves are now sufficient to last 24 years at the present rate of use. In 1966 they were estimated to be sufficient for 24.3 years. A small change in reserves over the course of a single year may not be very significant. What is important is the fact that long-term use is increasing and huge expenditures will be necessary to maintain Canada's crude reserves.

The rate of use, it is expected, will increase not only by the growth of Canadian markets but, hopefully, by increased exports, especially to United States markets. Plans have been approved to expand the capacity of the Interprovincial Pipe Line from Edmonton to Sarnia, which will include a loop via Chicago. Interprovincial is only one of the expanding pipe lines in which Imperial has an ownership interest. Rainbow Pipe Line, which used to run only 237 miles from Nipisi to the Rainbow oil field, now extends another 185 miles south to Edmonton and 59 miles farther north to Zama Lake. As a Suez emergency move, the average capacity of Trans Mountain Pipe Line from Edmonton to west coast terminals at Vancouver and in Seattle was expanded by 20,000 barrels a day.

Pipe lines and other forms of transporting oil are vitally important to a company like Imperial, whose people not only produce oil but manufacture oil products and sell them as well. Refineries are not always located where the oil is found; in fact, of Imperial's nine refineries, only those at Edmonton, Calgary and Norman Wells are served by nearby major oil sources. In the case of Sarnia, the

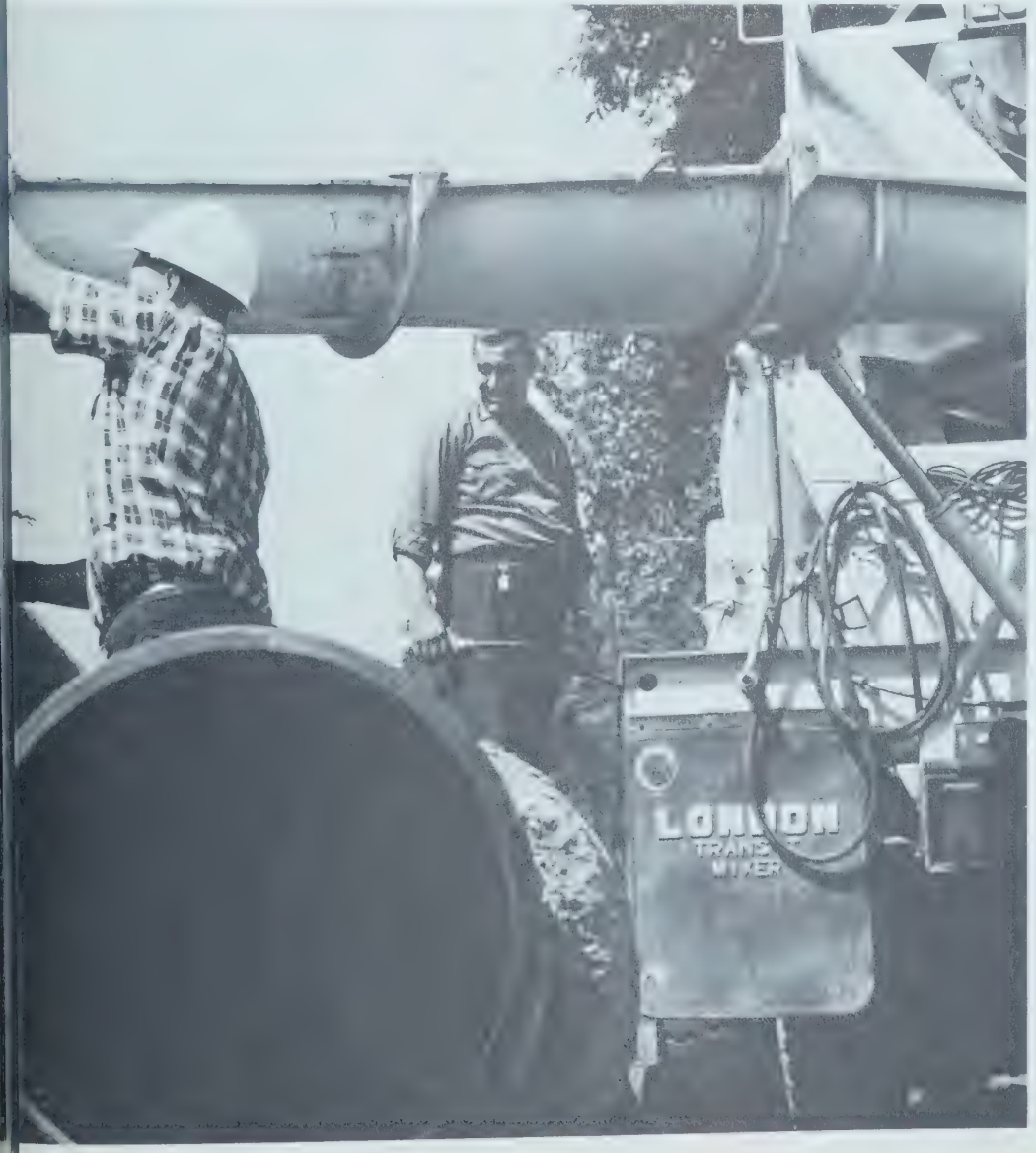
Mud-splattered roughnecks at Rainbow guide a fresh drill bit into the hole on an Imperial rig

total daily production from the local Ontario fields would keep the refinery going for no more than 54 minutes. To make sure the crude oil gets from where it is to where it's needed requires a vast network of pipe lines, ships, railroads, even trucks sometimes. Canada suffers from its size in this regard: the oil fields are in the west, but the big markets are in the east. To connect the two requires facilities enormously more expensive than any one company can afford. The Interprovincial Pipe Line, for one example, stretches 1,930 miles from Edmonton to Toronto. It's the longest crude oil pipe line in the world, but it's only a part of Canada's pipe line system–if you add all the major gathering lines, product pipe lines and crude lines like Interprovincial you get a figure of 13,403 miles.

In addition to the pipe lines, Canadian refineries depend on a fleet of oil tankers. Imperial alone operated 12 tankers in 1967 with a combined capacity of 1.4 million barrels of oil, and had charter arrangements with other ships, the number depending on the circumstances at the time. The largest ship ever to enter Halifax harbor–the *Imperial Ottawa*–is under long-term charter to Imperial, carrying crude to the Imperial refinery at Dartmouth and to the Montreal pipe line terminal at Portland, Me. Jumbo rail tank cars are now in use that will carry at least twice the amount of petroleum products that was common even as little as five years ago.

The employment of all these different methods in the movement of crude oil and petroleum products is an occupation for people who deal in split seconds and sometimes see high adventure. The pipe lines are highly automated, centrally controlled through consoles studded with literally hundreds of buttons. The control console for the Sarnia Products Pipe Line, a 188-mile line from Sarnia to Toronto, has 35 screens and 300 buttons, and cost $150,000 when it was built. The people who operate such consoles must possess a high degree of skill and a certain kind of unflappability, but for high adventure you can't beat the annual dash to Resolute Bay, an outpost so high in the Arctic that the sun never rises for nearly 12 weeks of the year. Resolute's harbor is ice-free for only two weeks in the year, and in that brief period ships must run in, decant a year's supply of petroleum products (it's an airport, emergency landing strip and weather station) and get out again. This summer a crew will be working at Resolute to move the storage tanks closer to the beach so that the products can be piped into them directly from the ships, lessening the danger from sudden storms–there's no dock at Resolute.

Concrete shield protects seam at St. Lawrence river crossing of Montreal-Drummondville pipe line



Of course crude oil isn't much use to anybody until it has been through a refinery. The 3,080 men and women of Imperial's manufacturing department operate nine refineries, including the country's biggest at Sarnia, and the second biggest, at Montreal. The third biggest is B-A's, also at Montreal. Every day 350,000 barrels of crude oil go into Imperial's refineries, and more than 700 different products come out.

Imperial is the largest supplier of petroleum products in Canada (and, incidentally, Canadians are the most avid consumers of petroleum products in the world–we use 23.1 barrels per capita, or roughly 2½ gallons a day each. The next biggest consumers, the Americans, use 22.6 barrels). Imperial serves its host of customers through a wide variety of outlets ranging from barges that ply the harbors of Montreal and Halifax, through fertilizer warehouses dotting the prairies, to the familiar Esso service station.

The figure that represents service stations in the statistical tables of Imperial Oil is one of the few figures that gets smaller with the years. Sixty-nine new stations were added to Imperial's chain last year, but 180 were closed, and while this might give the impression that Imperial's service to its customers is being reduced, the opposite is actually the case. The service station market is changing as the needs of the motorists change. Imperial reflects these changes by building new service stations to meet new needs. Imperial has pioneered the development of the automotive service center–a one-stop super service station where the motorist can get anything automotive from a tankful of gasoline to a major overhaul. A single center of such unparalleled scope can cost as much as $1 million, and serve a large area. The closing-out of outmoded stations is part of this development, and it is being carried out by a program that confers benefits on customers, dealers and company alike.

Although gasoline, heating oils, diesel fuels and heavy fuels are the principal products made by Imperial and the other petroleum manufacturing companies in Canada, they are far from being the only ones. Petrochemicals are increasingly important products of oil refineries, and in petrochemicals Imperial is a leading producer–it makes more ethylene and benzene than any other company in Canada, and is the only company manufacturing acrylonitrile, propylene 90, Paradyne 20, heptene, and some of the solvents. The uses of these substances include the manufacture of synthetic rubbers, plastics, paints, anti-freeze, gasoline additives, synthetic fibers and industrial coatings. And Imperial's petrochemical production will increase; three new chemical plants were brought into production last year, two more were expanded, and the further ex-

pansion of another was announced. At the end of 1967 Imperial was operating 17 plants producing petrochemicals, and others were under construction.

Among the biggest undertakings of all being tackled by Imperial now are the fertilizer manufacturing plants near Redwater, 40 miles northeast of Edmonton. Although not directly related to oil, the fertilizer business in western Canada appealed to Imperial for two reasons: first, there was an obvious need developing in the area for high quality fertilizer products in dependable supply and ready availability; and second, Imperial had an organization of 550 agents already serving the same market. Some aspects of fertilizer manufacturing are similar to oil refining techniques, but it was the business opportunity that persuaded Imperial to start manufacturing fertilizer.

In somewhat similar ways, Imperial has embarked on other ventures not directly related to oil. In their search for oil, for example, Imperial's geologists have inevitably discovered evidence of other minerals. Airborne magnetometer surveys, geological examination of surface outcrops–even core drilling–have indicated the presence of minerals other than oil, and in recent years Imperial has deliberately broadened its search to find economically recoverable deposits of these other minerals. One of the results of just such a non-oil search has been the discovery of a large deposit of columbium in northern Ontario. The value of the discovery has still not been proved, but test work is being done to determine how profitable it would be to mine the deposit. Other searches are under way–notably for uranium in Saskatchewan–and other discoveries will be made.

In Nova Scotia, Imperial Oil is in the iron business, at least to the extent of using some aspects of refining technology in the reduction of iron ores to highly concentrated briquettes of iron that can be charged directly into a blast furnace. The techniques are experimental, as is the pilot plant itself, but the lessons being learned there will be of incalculable value. Research, like education, is essential to progress, and the more a country and a company has of both the better off they will be.

Technician George Gander inspects a plastic bottle at Imperial's Sarnia PVC applications lab

Photos: Imperial Oil Ltd.

Imperial's research laboratories at Sarnia and Calgary constitute one of the biggest private research undertakings in Canada with a total staff of 388 men and women. Imperial's research effort will be expanded; the company has just completed putting a $750,000 addition to its Sarnia research laboratory.

Imperial is also represented in the marketplace by subsidiary companies whose names and products seem remote from the oil business. Two of its wholly-owned subsidiaries are Building Products of Canada Limited and Polybottle Limited, which together employ 1,719 people. Polybottle makes plastic bottles (using petrochemicals produced by Imperial) to serve a Canadian market that was consuming plastic bottles at the rate of almost a quarter of a billion a year in 1967. Building Products, as its name implies, makes products for the building trade in its eight plants in Quebec, Ontario, Manitoba and Alberta. The building trade is a natural avenue for an integrated oil company like Imperial to find expression, not only because it uses so many petroleum-derived products (vinyl floor tile and asphalt roofing are only two floor-to-ceiling examples), but also because the scale of the market involved and many of the techniques of management are compatible with the experience of Imperial. A third subsidiary –Poli-Twine Corp. Ltd.–makes synthetic baler twine (and synthetic twine for many another purpose) as well as rope, in their Saskatoon plant. Plastic baler twine does everything that sisal baler twine does, only much better. It's not indestructible but it's tough and durable, very strong for its weight, resists rot, and can be made consistent in quality, and it never frays, stretches, or varies in quality from one season to the next.

You can add it all up in a lot of different ways. From a profit-and-loss point of view, Imperial's earnings in 1967 were more than $95.5 million–the highest in the company's history–which may look like a lot, but represents a return on capital invested of less than 10 per cent. In the last year and a half Imperial has had to borrow $100 million. Dividends on Imperial Oil stock were $2.10 a share in 1967 and capital employed went over $1 billion.

The largest beneficiary of Imperial's record level of achievement was the tax collector. For every dollar the company made in 1967, it charged taxes in the amount of $1.22 against income and paid another 28 cents in fees, royalties and bonuses to governments–a total of $1.50. In addition, the company collected for provincial governments a further $2.05 in sales and gasoline taxes. In total, Imperial generated $313 million in taxes in 1967, and paid another $27 million in fees, royalties and rights.

This sort of bigness doesn't go unnoticed, and one result is that Imperial and the petroleum industry make inviting targets. The industry has been the subject of four investigations in the past five years, most of them

inquiring into the price of gasoline. The fact of the matter is that gasoline is one of the few products that–due to intense competition –was actually going down in wholesale price even before that time. In Imperial's case, the wholesale price of regular Esso gasoline in Toronto, for example, has gone down 2.3 cents a gallon since 1957. Imperial gets less, but you pay more for it today because dealer markups and sales and road taxes have risen. The way oilmen see it, the target shouldn't be the gasoline, but the taxes it is forced to bear. Somehow, though, the tax part seems to get lost from view, and only the price remains visible as a target. Maybe that's one of the penalties of bigness.

But there are other results. The petroleum industry has grown enormously in Canada, particularly in the 20 years since the discovery of big oil pools at Leduc, Alta., in 1947, and this growth has had a social aspect. It has transformed Alberta from a stagnating rural province with a declining population to a vibrant industrial land with a diversified economy and all the amenities that modern civilization can provide. Every 100 new jobs created in the production of oil and gas in Alberta brings into being, for example, 234 other jobs in other sectors of the economy. The oil industry has created new industries in Canada–in pipelining, petrochemicals, fertilizer manufacturing, to name only three–and Imperial Oil has been intimately involved in their creation. And the process is still going on. The latest example is the electronic machinery used by Imperial in its automotive diagnostic clinics. In preference to importing the expensive machinery from the United States, Imperial assisted Canadian Curtiss-Wright to set up facilities to make it here.

Imperial and the people who work for it have had other effects on the country that are not the kind you can measure. The company has a long, quiet history of capital and research grants to universities, scholarships and fellowships for students, and travel aids available for teachers through the Canadian Education Association. It has a policy of support for the arts that ranges geographically from the Newfoundland Historic Trust to the Vancouver Festival, including local institutions like the Regina Symphony Orchestra, regional groups like the Manitoba Theatre Centre, and country-wide organizations like the National Youth Orchestra and the National Ballet. Imperial men and women work for volunteer groups supporting every conceivable good work, and their activity ranges from participation on executive boards (President W. O. Twaits is a director of the Ontario Mental Health Foundation, a member of the advisory council of the Canadian Arthritis and Rheumatism Society, and a board member of the Canadian Council of Christians and Jews) to blood donations (a record-breaking 360 head office employees volunteered for a blood donor clinic last May) and the currently-popular marching for money (13 head office employees earned a total of $1,223.10 in a Toronto march last spring).

Cans spiral to filling machine at Imperial's 1,800-barrel-a-day Edmonton lubrication oils plant

The people in Imperial's head office staff number 1,105, but they are only a fraction of the 14,933 men and women who made up the total staff of Imperial Oil and its subsidiaries last year–a record number in the company's 88-year history. Those people do literally hundreds of kinds of work, ranging all the way from refinery trainees hired straight out of high school to Ph.D's in geophysics. The payroll hit $135,599,000 last year, a figure that doesn't include the earnings of Imperial's 1,506 independent dealers and agents.

Imperial is committed to Canada's future. This year, the company expects to invest approximately $200 million in capital and exploration expenditures–the greatest amount it has ever invested in any one year, and the largest amount any oil company operating in Canada has ever invested in one year. For its operations in 1967, Imperial spent $140 million on materials and equipment from Canadian manufacturers and suppliers–93 per cent of the company's shopping list.

What does it all mean? One thing it means is this: bigness is a liberating factor, freeing an organization like Imperial Oil to tackle big projects and, as a result, make a big impact in a country whose size cries out for big things done in big ways. Imperial's size makes it able to do big things, and the benefits go beyond Imperial Oil to affect the country at large–making more jobs, creating more wealth, raising the living standard, strengthening the economy, and contributing in a real way to the greatness of this nation. □

The man who knows

by Robert Collins

It has mystified men almost since time began, this thing called water 'witching', or 'dowsing' or 'divining'. Nobody can really explain it, least of all Art Poitras, Imperial's gas plant utility man, at Red Deer, Alta. Yet Poitras is himself one of the mystery men, a dowsing virtuoso, an instrument of strange and potent forces. Scores of times (he hasn't kept count) in 45 years he has used a forked willow branch to find underground water, usually in places where science and technology have failed. Poitras has never failed—and never understood why he succeeded.

There was, for example, the Judy Creek incident of 1962. An Imperial crew was building a gas plant at Judy, the famous field 140 miles northwest of Edmonton. A good supply of water was essential, but apparently non-existent. A contractor drilled a 300-ft. dry hole. Attempts to pipe water overland from five miles away were unsuccessful.

'We have a man named Poitras over in Drayton Valley,' somebody said. 'He witches wells.'

'Depend on a guy with a stick to find water for a multi-million-dollar gas plant?' scoffed resident engineer Chuck Collyer. 'I don't want any part of that stuff!'

They began trucking water, an expensive temporary arrangement. The only permanent solution appeared to be a $50,000 pipeline and pumping station. Collyer reluctantly sent a company aircraft for Poitras.

The man who stepped off the plane was neither witch, warlock, mystic or kook. He was 51 and balding, with the hard, thick build and windburned look that comes from a lifetime outdoors. He had a modest manner, a trace of French accent and seemed genuinely embarrassed at the crowd that invariably gathers around dowsers (as witchers prefer to be called).

The first thing he did was climb a tank truck to view the topography. Poitras works best on undisturbed ground. In this case the land was torn by construction and Poitras had to rebuild it in his mind, looking for signs to help arouse the peculiar thing that happens between him, the twig and hidden veins of water. He noted the location of tree thickets, the profusion of leaves, the size of tree branches, even the color of the leaves and grass. ('Plants have healthy or unhealthy complexions, just like people,' Poitras explains.)

Then he took a fresh-cut pliable Y of red willow, just thick enough for a firm grasp in his huge hands. He grasped each arm of the Y, his knuckles down, his thumbs toward the small ends of the branches in the grip most dowsers favor, with the butt end of the branch extending forward and up at a slight angle. First he walked the boundaries of the site. At intervals the twig moved uncontrollably, pointing at the ground. Poitras crossed and recrossed the area, plotting the points indicated by the twig.

After three hours, wrists aching and palms blistered from the twisting willow, he said, 'You'll find water here.'

'Well,' said Collyer, apologetically, 'we'd kind of planned to put a compressor there.'

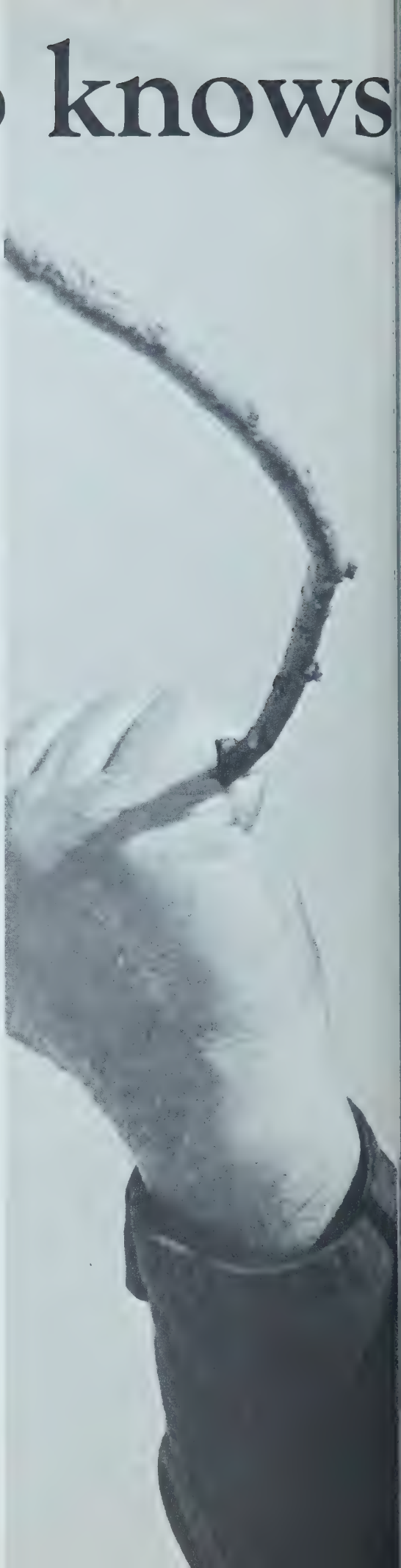
'All right,'' Poitras said amiably, moving to another site. 'You'll get water here, too.'

The crew drilled, and found 10 gallons a minute at 150 ft. Poitras' well served the plant for years, until a second plant increased demand beyond its capacity. But by that time water was being piped to a waterflood project nearby, and both plants tapped the pipe.

Last year, when Collyer was having trouble finding good drinking water at Imperial's Redwater fertilizer plants, he summoned Poitras again. Here the site was ravaged by construction. Poitras was bitterly unhappy. 'There was nothing to give me a feeling of what the ground had been,' he said. He looked over the 200-acre site for a few hours, then went to lunch. When he came back he was still gloomy.

'Shall I pick you up in an hour or so?' asked Collyer hopefully. 'I almost told him to go fly a kite,' Poitras recalls. But he took up the search, bearing in mind Collyer's preferred location. Late in the day he said: 'I've got you three locations. The best one is way out on the edge of the site. There's another, closer but not so good. And where you want the well there's water but not enough.'

Then he went home, exhausted. Like all genuine dowsers, he finds the work drains him. ('It's as though it takes the power, the virtue, right out of you.')



Photos: Ron Cole

where the water is . . .

. . . He doesn't know how he knows;

The company drilled the third-choice site first and found a trace of water. Next, the second choice: better but not enough. On Poitras' first choice Imperial found 30 gallons a minute of potable water at 125 ft. It still serves the plant. Process water used in manufacturing will be obtained from the North Saskatchewan River.

'I've ceased to be a skeptic,' Collyer says now. 'I endorse the guy completely. I'd never sink another well before asking Art to put his blessing on it.'

But Poitras still frets at the memory of Redwater. 'It could have been my first failure. This built-in faculty some of us have, we shouldn't abuse it. It's too good, it's a kind of *sacred* thing. If a dowser feels something is wrong with the situation, he shouldn't try.' As for the faculty itself: 'I can't explain it. It just works!'

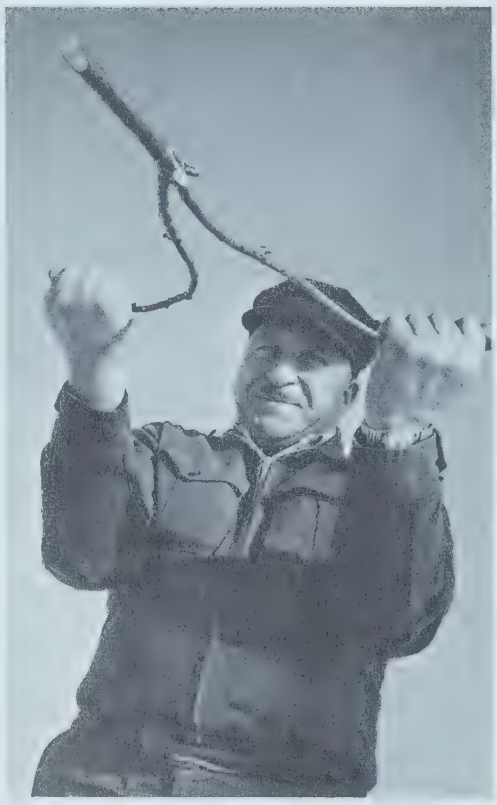
He's not alone in his puzzlement. Few scientists and almost no dowsers have a rational explanation. But there have been diviners of sorts since antiquity. Divining rods helped the Scythians detect perjurers and the ancient Germans detect murderers. The early Greeks had a word, 'rhabdomancy', meaning to find water or precious minerals with a rod. Some dowsing enthusiasts even suggest Moses was a witcher when he smote a rock to produce flowing water.

The divining rod was first widely used in 15th century Germany, to find ore. The fad spread all over Europe. Soon nobles, peasants, priests and philosophers all had hold of the rod. The champion witchers of the time, until they were jailed for sorcery, were French Baron de Beausoleil and his wife, who reportedly found minerals *and* water.

Widespread witching for water had its first vogue in Cornwall, following upon the adoption of the German ore-divining technique to Cornish tin mines in Elizabethan times. Here the word 'dowsing' probably originated, derived from the local colloquialism 'to dowse a sail'– meaning to lower it, as in the dipping action of the divining rod or twig.

Since then at least 600 books and papers have been written on the subject. Many countries, including the United States, have assigned committees to investigate it. Most such reports have been inconclusive or downright scornful. Engineers and geologists tend to condemn dowsing on general principles. Charlatans and exhibitionists in the business tend to further damage the probity of sincere dowsers like Poitras.

But not all scientists or governments are doubters. In 1931 British Columbia hired an



English lady witcher to find wells in the drought-stricken Okanagan, and she did. Ontario employed a dowser to find water on farms sold by the farm loan department in the 1930s. There are many other proven successes.

But *why* does it work? Only the more wild-eyed dowsers really believe the kind of twig, rod or other device has anything to do with it. Most, like Poitras, prefer a twig of willow or hazel, originally based on the affinity those trees have for water. But others have used plumb bobs, pendulums, nylon rods, wire, keys, Bibles, crowbars, scissors, buggy whips, corset stays – even sausages. Ten years ago a Manitoba witcher reportedly found wells by padding around in his bare feet.

The mystery therefore lies in the dowser himself. Serious scientists have been trying to unravel it since 1556 when Georgius Agricola wrote in Latin that diviners were good conductors of certain unknown waves emanating from hidden treasure or water. It was accepted that non-witchers couldn't conduct such waves for the same reasons they believed a magnet smeared with garlic juice couldn't attract iron, despite the fact that it can. Variations of this theory are still around: that a dowser is a conductor of sorts, inducing a magnetic, electrical or other 'field' between twig and water.

But the best explanation, and the definitive work on dowsing so far, is from English writer D. H. Rawcliffe. In his *Illusions and Delusions of the Supernatural and the Occult* he states: 'There is nothing about dowsing for water which cannot be accounted for in terms of present-day psychology.'

Movement of the twig is a form of 'motor automatism', Rawcliffe maintains. The dowser holds the two forks of springy wood bent outwards at an angle. This sets up considerable torsion and a low degree of stability. The slightest movement of the hand will move the twig.

'The forked rod of the dowser merely serves to register and magnify small automatic movements of the arm and wrist made independently of the conscious volition of the operator,' says Rawcliffe. A twig may thus move even for beginners but it doesn't necessarily mean they have found water.

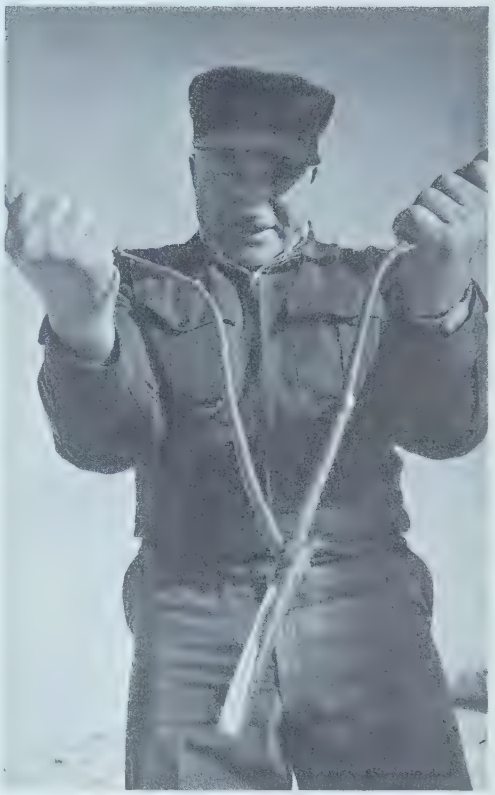
So what causes those involuntary *and* accurate muscular signals in a true dowser? 'The success,' says Rawcliffe, 'lies in his subconscious powers of observation.' His subconscious registers and interprets faint sensory clues and translates them into automatic muscular movement.

In the experienced dowser, the subconscious clues are combined with–perhaps inextricably linked with–his conscious search for clues. Consciously–as to a degree with Art Poitras–or subconsciously, he is seeking differences in the color and type of soil and vegetation, texture and dampness of soil, differences of temperature in the atmosphere, even the feel of the soil underfoot. He may have an extraordinary sense of smell which, whether or not he knows it, reports the presence of ground water. He may subconsciously sense the tiniest vibrations from the movement of water through porous rocks underground.

The ability to detect such clues is usually called a 'gift'. There's a more scientific explanation. Sensory stimuli must reach a certain intensity before they enter the threshold of consciousness for most people. 'But there is a borderland region in which diffuse stimuli of low intensity may affect the individual subconsciously and which are often responsible for intuitions, vague premonitions, "inspired" guesses and the like,' writes Rawcliffe. 'The sights, sounds and smells are not consciously registered as such but give rise to a vague feeling of awareness which cannot be specifically traced to any recognized cause. It is in this borderland region that the true dowser finds his metier.'

Poitras, like most dowsers, would be as-

he just knows he knows



tonished to learn that all these forces are jockeying around inside him. But he knows that certain conditions must be met and that the situation must 'feel' right. He discovered he was a dowser at age 12, after watching an old man witch wells around his farm home near North Battleford, Sask., and finding that 'it seemed to come to me'. As a teenager he practised his skill and developed an awareness of what works best for him.

In Poitras' case, he must be directly over the water source; he can't detect water miles away as others claim to do. The force of the pull in his hands tells him, in terms that only he can interpret, the approximate depth and quantity of water. He never lets anyone handle his twig during a serious search. He won't work with crowds pressing around. He refuses to ask a fee, unlike some witchers who are inspired only by the presence of folding money, but he will accept one. And he never *offers* to find water.

'People laugh at this and consider me eccentric,' says Poitras. 'But I have to be *asked* to find a well. Once at Drayton Valley, Imperial needed a well for water injection. They talked about it but nobody gave a direct order. Finally the foreman said, "I want you to go out tomorrow and find us a well." Then I did–in 10 minutes.' He located a supply 400 ft. deep that produced 400 barrels a day–a supply that was adequate for several years.

Also at Drayton, Poitras demonstrated that drilling technique is as important as dowsing. He found a spot for a farmer's well. The farmer hired a driller. No water. Poitras urged the client to try another driller, noted for his sensitivity with the tools. This time the well came in where Poitras said it would.

Poitras has never considered himself a professional dowser and has gone for years without using the twig. As a young man he was a prospector, handyman, hunter, lover of the far north ('Fish in abundance, bear in abundance, flowers–it's phenomenal!'). Twenty years ago he joined Imperial, where he's been everything from cook to roughneck. He rarely talked of dowsing except to close friends. But occasionally the fascination of the twig drew him back.

Once in Kelowna, visiting a brother who worked for a driller, he was helping dig a well on a notoriously dry celery farm. It looked like a dry hole. Automatically Poitras began 'studying for my own edification', using a willow, talking to old-timers, building a mind-picture of how the area used to look. He concluded that water lay hidden beneath a thick overburden of silt, and persuaded the farmer to dig a well.

At 75 ft. the owner wanted to quit. Poitras pleaded: 'Let us dig a few more feet. If we get water, you pay for the extra labor. If we don't, you don't pay a cent.' The well came in at 92 ft. and 'the lady of the house was so happy she took pictures of us.'

Poitras seeks only water and is skeptical of diviners who claim to forecast the future, divine the sex of eggs, diagnose diseases or find hidden treasure, lost animals and criminals. Nor does he associate with others of the reportedly 25,000 dowsers in North America. He ignores the annual meetings of the 1,700-member (including 33 Canadians) American Society of Dowsers. 'What can we teach each other?' he asks. 'We don't understand it ourselves.'

He's particularly mystified by dowsers who claim to find oil. Poitras' own successes are with channels of moving water, and oil is found as millions of drops trapped in the pores of underground rock. But a U.S. dowser named Ray Poppleman claims to have found 13 oil wells. And Evelyn Penrose, the Britisher hired by the British Columbia government in 1931, told in a 1932 issue of *Blackwood's Magazine* of dowsing a large oil field in the Peace River country. Eleven miles from the field, she said, she felt 'a violent stab through the soles of my feet like a red-hot knife. When over the field itself, the action of the rod was so violent that I was turned and twisted about like a doll . . . On the strongest dome of the oil field the shock was so great that I crumpled up and collapsed.' (Oil was subsequently discovered in that part of the country, but not until 30 years later, and several fields have since been brought into production.) She concluded that water, minerals and oil give off electromagnetic waves and that diviners 'are merely human radio sets tuned in to these wave lengths.'

Poitras never performs such gymnastics but he observes, with considerable awe, that his subconscious sometimes reports water *without* the twig. 'It happened the other day, right out here on the street,' Poitras said one night last spring. 'I got out of my truck and *felt* there was water near. I cut a twig, and there *is*. I'll show you.'

He led the way outside the rooms where he lives alone in Red Deer. He grasped a willow twig and moved slowly back and forth across the pavement. Again and again it twisted down in his seemingly motionless fists. 'The vein seems to run that way,' he said, pointing to an open field. 'Here, you try it.'

I clutched the twig in approved fashion. It lay still and sullen in my hands. Poitras shook his head. 'And yet it works for me. Is it ESP? Static electricity? I just don't understand it. I'm not even going to try!' □

Potter

It's easy once you get the hang of it only getting the hang of it takes years

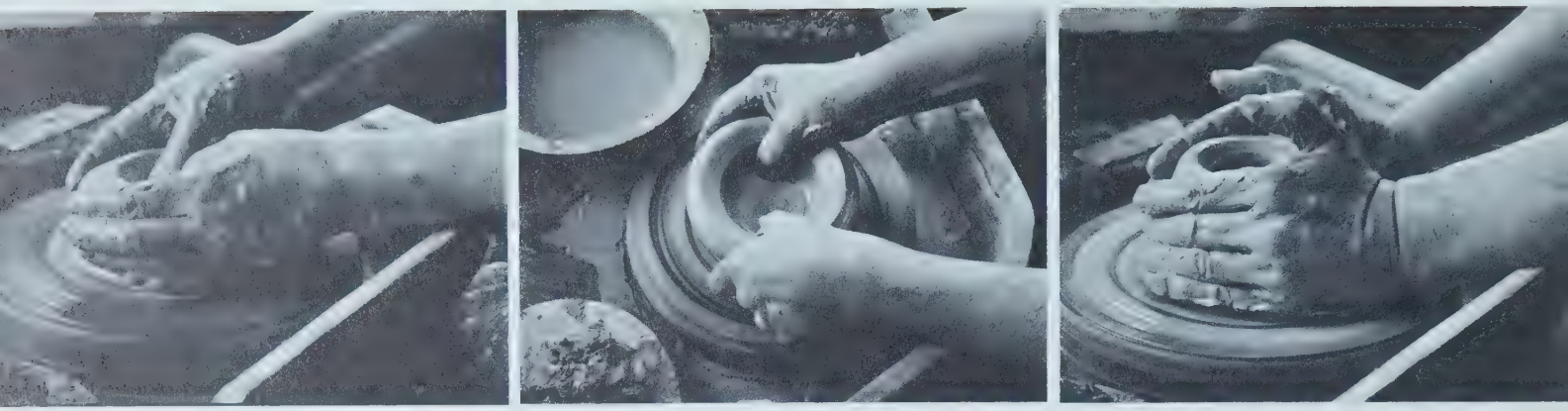
by Vicki Innes / photos by Ron Cole

It looks so easy to use the potter's wheel. Albrecht Schoenborn simply places his fingers on the twirling lump and the clay seems to take shape all by itself. But it isn't really that simple. In fact, the beginning potter has so little control over his lump of clay that it often really does take shape by itself. 'The potter makes first what the clay wants him to make,' Schoenborn explains. 'It takes a good many years before the potter gets what *he* wants to get.'

Schoenborn, a photographer who works at Imperial Oil's head office in Toronto, is a good enough potter by now to get what he wants from his clay *most* of the time. He's good enough to have had his pots accepted in last year's Canadian Ceramics biennial show, the only national touring exhibit for potters. And a Schoenborn teapot was chosen third best out of the 100 accepted entries in a national design competition sponsored by the Tea Council of Canada in 1964.

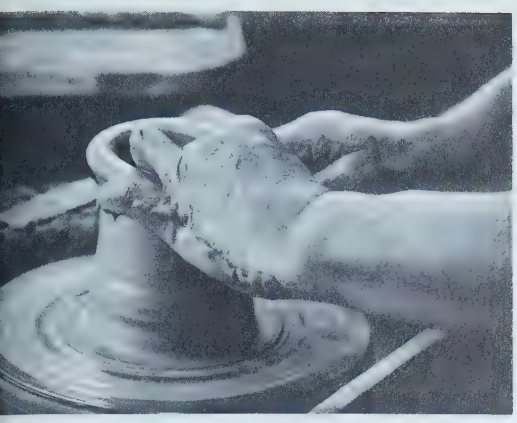
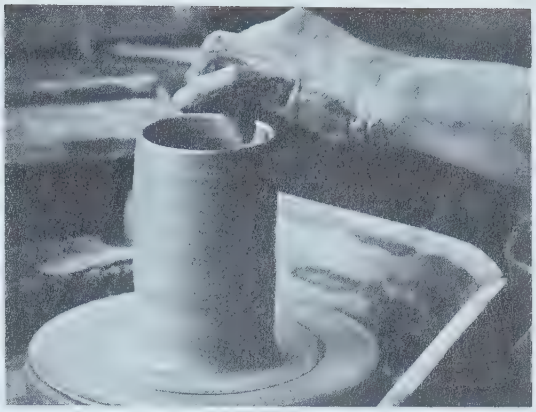
Like most of Canada's uncounted

Al Schoenborn's work: a green vase with crystalline glaze, the prize-winning tea set, tea pot and a pair of milk jugs

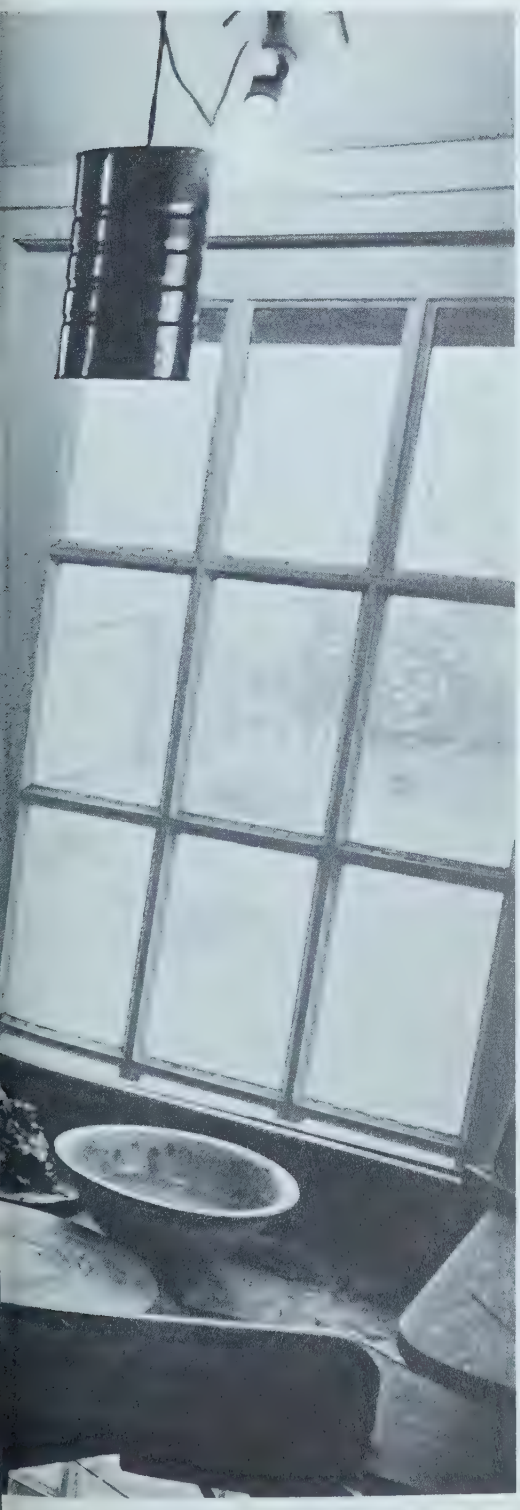


To make a beer mug, Schoenborn opens a lump of clay with his thumbs, then compresses the top to form a mouth

While the mugs wait for their handles, Schoenborn weighs chemicals for glazes he will use when he fires the set


He pulls the sides up and finishes the rim. Since the mug is to be part of a set, he measures its diameter with calipers



thousands of amateur potters, Schoenborn finds an outlet in clay for the skill in his fingers. Canada has its internationally-known potters, such as Jack Herman, of Kleinberg, Ont., Ron Roy, of Scarborough, Ont., and Jack Sures, of Regina.

But most of the ceramics made today are produced by amateurs like Schoenborn for the satisfaction of it. What is the satisfaction? For Schoenborn, it's a creative pleasure. 'Pottery is something you can cuddle and love,' he says. And, he feels, pottery satisfies the urge in many people to make something with their own hands. Handmade pottery—lacking perfect symmetry, not quite smooth, perhaps showing the finger marks of the potter—has an originality you don't find in mass-produced articles.

The appeal of the handmade helps explain the growing demand for courses in pottery. At Toronto's Central Technical Institute, for example, pottery started more than 50 years ago as an extension course held several nights a week; now it's a full-time subject, taught five days *and* nights a week. The school's graduates have won prizes in international competitions. The same enthusiasm is evident in the swelling enrollment in day and evening courses in pottery and ceramics in Halifax, Montreal, Winnipeg, Regina, Calgary and Vancouver. The courses range in scope from making simple ashtrays to creating vases on the potter's wheel.

The process appears simple enough. Just toss a lump of clay on the flat base of the wheel as it spins and shape it with your fingers.

But there are many difficulties to overcome. Like getting the clay centered on the base. 'This is a hard part to learn,'

The mugs dry for a week, then get fired

Schoenborn says. 'The ball looks like it's on center but the sad truth is the opposite. Because of the centrifugal force, the clay wants to go everywhere except to the center.' The wider the pot, the more likely it is to bulge in the wrong spot; like the man on the end of a line of wheeling skaters, the outer edge of the pot is under greater strain than the rest. Another challenge is getting a pot shaped so that it won't collapse under its own weight. A pot with a big belly and a tall, narrow neck is a particularly difficult shape. If too much water is used to lubricate the clay spinning under the potter's fingers, it will become too soft to support its weight. And it doesn't help to slow down: the pot *must* be finished quickly or the clay will get too soft from the lubricating water.

The potter's speed increases with practice. There is a Japanese potter who can make 100 handleless coffee mugs in an hour–one every 36 seconds. Schoenborn can make a decorated plate in 10 minutes, but it still takes him several hours to make the spout, body, handle and lid of a teapot and fit them together.

Schoenborn is meticulous, and the aim of all his care is something functional. The most important thing about a teapot, in his view, is that it pour well. Its appearance comes second. Schoenborn has a motto: 'To be as good as I can be.'

Schoenborn is a relative newcomer to pottery, although he has been interested in the craft for most of his life. As a student in Germany, he studied pottery design but got to try the potter's wheel only once. He graduated as a ceramist in 1929, just before the Depression. Unable to find work in his field–the design and factory production of pottery–Schoenborn took on a variety of jobs and in 1940 became a movie photographer, work that led to his present position with Imperial Oil in Toronto.

But he still wanted to throw pots. In 1961, on a visit to Germany he photographed an old friend, Hubert Griemert, at his work on the potter's wheel.

'Watching him at the wheel was the last straw. I had to do it,' Schoenborn reported. Within three months, he had enrolled for private lessons with Chizuko Shimano, of Bay Ridges, Ont., an instructor of evening pottery courses at Central Technical Institute in Toronto.

Today, after six years' experience, he says he's still learning. 'I'm just over the first stupid stages and I'm limited in what I can do,' Schoenborn says in his soft, slightly-accented English. 'It takes great patience at the beginning.' It was three months before he made his first pot, a little vase. Once he mastered the basic steps, it was, he said, like 'growing wings and suddenly being able to fly.'

Schoenborn will be flying solo in 1970. That's the year he retires from Imperial Oil to take up a new career as a full-time potter. It will also give him the opportunity to get started on his own personal crusade. Schoenborn finds most factory-made pottery badly designed and garishly decorated, and he sees no reason why it can't be functional and attractive as well as cheap. Retirement will give him the time to make his own designs for mass production, and the opportunity to put his theory to the test. □

The kick-wheel is foot-powered, though a motor is sometimes used. Schoenborn finishes the mug lip with a soft chamois

Splashdown

Twenty-eight men sealed inside an ellipsoid eight feet high and 13 feet in diameter were lowered 65 feet into the rough water of the North Sea recently from Esso's offshore drilling platform *Ocean Traveller*. The men were testing a new survival craft that is a radical departure from an open lifeboat. The spherical vessel has some impressive characteristics: it is self-righting and protects survivors from exposure to sun, wind or cold. With its fire-resistant materials and air purification system, it can negotiate burning oil. And it comes equipped with two-way radio, a 20-h.p. diesel engine, a blinker light visible for 50 miles, a compass, and enough provisions for five days.

Drilling stations *under* the sea

One way to avoid the need for such survival craft is to drill offshore rigs *underground.* This startling proposal has been made in California to develop properties under the Santa Barbara Channel. Resource consultants there suggest a tunnel running from an onshore operating base, seaward under the channel floor. Chambers connected to the main tunnel would house conventional land-type drilling and producing equipment. The complex would thus be safe from weather and shipping hazards. Other advantages are lower daily operating costs than offshore platform operations and no limitations due to water depth. For all practical purposes, you can't drill in depths greater than 600 ft. today.

What is drilling, anyway?

People have been drilling for oil on this continent for more than a hundred years, yet they still don't completely understand the drilling process. To add to their knowledge, Esso Production Research Co., has set up a full-scale drilling rig inside its Houston, Tex., laboratory. The lab duplicates field conditions as closely as possible. Blocks of rock, weighing nearly two tons each, are positioned on a steel plate for drilling tests. Below the plate is a 65-ft. deep well for testing equipment and new materials for pipe. Another well provides a chamber to pressure-test equipment. There are also mud pits each capable of holding more than 100 barrels of the drilling fluid. The installation is probably the most complete in the world and will provide data more cheaply than field tests.

Deer troubles

Deer are having their troubles these days. Last year in Ontario, 458 deer ran into the paths of oncoming motor vehicles. The second most accident-prone group was cattle; 437 of them were involved in accidents. Dogs were luckier than you might expect; only 196 collided with motor vehicles. Also involved in accidents were 196 ponies and horses, 153 moose, 45 bears, 22 pigs–and one hippopotamus. The hippo lumbered into a car on Highway 2 near Brockville after its escape from a roadside zoo. The car was damaged but neither the driver nor the animal was injured. However, collisions with other animals cost the lives of nine people–five in one accident–and injured 236 more. The 1,434 accidents reported last year, some involving more than one animal, were an 8.4 per cent increase over 1966. More of them occurred in Thunder Bay than any other district of the province.

Plastic-lined lakes

A chemical company has lined a 5.6-acre lake with plastic as part of its anti-pollution program. The lake will hold 21 million gallons of process water for a week, allowing it to regain normal oxygen content. The plastic liner keeps the water from seeping and contaminating underground water. The plastic-lined aeration pond–the world's largest–is the key facility in a new waste disposal system that will reduce by 90 per cent the effluent discharged by the company into New Jersey's South River.

Chop and open!

No fiddly unwrapping is needed to open a box of men's pyjamas sold by a New York shirt company. A single karate chop does it. And anyone can deliver the blow, thanks to the packager's ingenuity. The carton looks like wood, but it's really bleached-sulphite board, perforated around the midsection. It can be split by you or me as easily as a karate expert splits a real two-by-four.

Pedagogical plastics

If you're the kind of person who prefers playthings that are practical, here are some petrochemical poppets to put on a pre-Christmas shopping list: a seven-foot long polystyrene dinosaur skeleton weighing only 2¼ lb. that can be assembled from a 30-bone kit; interlocking polypropylene blocks that can be made into flexible models ranging from robots to animals; sturdy and washable toy animals made of fluffed polyethylene film. These toys, demonstrating various uses of plastic, were shown at a toy fair in New York in March.

The last word

How to: reduce the number of service stations in town, cater to the modern one-stop motorist, earn the mayor's gratitude, keep up with city growth, get a fan letter from a civic beautification committee, increase municipal revenue and show a better profit at year's end

Once upon a time an MPP went to Ottawa and made friends with the mayor, and gave the city more money, and won a fan letter from the director of planning, and made the city prettier, and . . . .

. . . And at this point you should know that an MPP is a *thing*, not a politician, and this is not a kiddies' bedtime story. There's only one fairytale quality to it: it has a happy ending for everybody.

MPP stands for Market Pattern Program–a new, efficient way of serving the motorist. Imperial Oil introduced it to Ottawa, and the world, in 1962. It is now at work for the company in 45 other Canadian markets. Esso affiliates from around the globe have come to study it. And, among the people they've talked to, happiness is the MPP.

Imperial shareholders like it because it helps offset rising costs of construction materials and labor. Customers like it because it means better service. Service station dealers applaud it because it gives them more money, better working conditions, or both. For municipal governments, MPP means more tax revenue. Town planners approve because MPP results in fewer yet more attractive service stations. Already, across Canada, Imperial has reduced its company-owned stations from 1,032 to 979 over a period of three years ending in 1966. All Imperial stations share a consistent design approach, but many have interesting faces. They may be coupled with a car wash, a service centre or restaurant. There may be a stone or wood front, a touch of landscaping, a roofline compatible with sur-

rounding buildings or, as in one Toronto location, a long sleek canopy that looks somewhat like the entrance to a ritzy men's club or a fashionable hotel.

In short, MPP is making Imperial and Canadian cities more prosperous, more diversified and more attractive. To understand how all this is possible you must hear–as Esso marketers from Sweden, Japan, Belgium, the United States and Australia have recently heard (and carefully studied)–how the MPP went to Ottawa.

In 1962 the Canadian petroleum marketing scene was torn by change. Over the span of 25 years the cost of building an average two-bay station had soared from $18,000 to $75,000 plus the cost of land. Mass merchandisers and private branders, employing new techniques, were cutting sharply into the market share of such major companies as Imperial. Cities were growing explosively; the whole environment was changing, and a new kind of motorist was evolving: mobile and far-ranging, demanding a one-stop plaza kind of shopping and expecting complete car service from gasoline to motor diagnosis. The corner filling station of a generation ago, like the neighborhood grocery store, had become obsolete in appearance as well as methods. Public complaints about too many and too ugly service stations were becoming a national chant. Actually, Canada's service station numbers had increased by only 30 per cent in 25 years, compared to a 75 per cent growth in population, a 323 per cent increase in motor vehicle registration and a 492 per cent increase in gasoline sales. All the same, it was felt that the time was ripe for a revolution in the service station field.

Imperial was the first oil company to study the whole problem in depth. One outcome was the automotive service centre with diagnostic clinic–a kind of car hospital. Another result was MPP. Basically, MPP said: 'Stop regarding the market in terms of each individual service station site. Map out an entire market area, study it as a *whole*, study its parts in relation to the whole. Study it as you've never studied a market before. Then plan a program that's good for the customers and good for the company, and work it out step by step, the way you'd plan a battle.'

The idea looked fine on paper, but would it work? To Imperial's knowledge there was no plan exactly like it in the world. For the first field test the company chose Ottawa. As fifth largest city it was one of Canada's major markets. Its rivers, bridges and business/residential makeup posed tricky geographical problems which, in theory, MPP would thrive on. Its National Capital Commission–a federal body which has the power to appropriate land and set beautification standards for the park-like 'greenbelt' that hangs like a horseshoe around the capital–has the most rigid aesthetic requirements in Canada.

Into Ottawa went a three-man team headed by Ralph Holt, investment planning coordinator for Imperial's Ontario marketing region, a lean, amiable ex-trombone player, now in his early 40s and with 24 years petroleum marketing experience. He and associates Dick Hunter and Al Morrison were about to launch a remarkable research blitz. By the time they were through, they would have learned more about the city than anyone else in it, with the possible exception of the city's own senior planning staff.

By day the team fanned out through Ottawa like commandos, gathering data according to plan. By night they worked late in their motor hotel, sorting, assimilating, interpreting. They went to the city clerk, industrial commissioner, Ontario department of highways, Dominion Bureau of Statistics, National Capital Commission, city traffic department, developers, contractors, engineers, planners, consultants, city councillors and the mayor of that time, peppery Charlotte Whitton.

'Miss Whitton soon decided that MPP was good for Ottawa,' recalls Holt. 'Right then, half the battle was won. When she gives an

Imperial's team studied Ottawa by day, transferred their findings to maps in their motel headquarters at night

order, people jump right into action!'

The team gathered maps and made notes of present and future population figures, zoning laws and service station bylaws. Service stations are perhaps the most strictly regulated businesses in Canada. Municipal bylaws may govern their numbers within a given area, their location, their hours of operation, the types of merchandise they may sell, the location of their pumps, the location of their entry ramps, the number of their signs, the side and rear clearance between the station and the property line, and whether or not merchandise can be displayed outdoors.

Imperial's threesome also studied the buying habits of Ottawans, the plans for new services (a new trunk sewer, for instance, might forecast a housing development which in turn might dictate a service station site). They found out where roads and expressways would run, years off in the future; where new subdivisions, high rise apartments, shopping centres and industries would be.

They calculated the traffic flow on all main streets: numbers of cars in specific hours of the day and the kinds of 'moves'. An MPP man knows, for example, that there are 12 possible traffic 'moves' at any intersection: right, left or forward from each of the four directions. The preponderance of moves governs the best service station site. The team recorded the number of cars in Ottawa, average number of people per car, average gasoline consumption per vehicle and the future car service requirements. They pinpointed the satellite communities that would grow up outside the National Capital Commission greenbelt and plotted the most desirable service station locations in those still-mythical communities.

before

Standard service station at Beechwood and Marquette Streets in Ottawa had two service bays and combined office and sales area

after

Same station, modernized and expanded onto additional property, now has three service bays, greater storage, and expanded sales space

They also took a hard look at the existing Esso service stations. What was the return from each? Should it be better? Was the property too valuable to be kept for a station, considering the available petroleum business? Who were the customers? Each Esso dealer was armed with questionnaires, seeking each customer's address and the primary purpose of the trip that brought him to the station. The answers were occasionally irrelevant, irreverent and painfully honest: ('I'm going to see my girl friend, so don't tell my wife'; 'We're strangers and we were lost'; 'None of your damn business!').

From the growing pile of data the team began to make maps. 'One day a chambermaid got into our working room, which we normally kept locked,' Holt remembers. 'She came out dumbfounded–the walls were literally papered with our maps, hung by Scotch tape.'

One map, to the uninitiated, resembled a weather map of Ottawa. What it showed in fact, was the marketing climate for each Esso station. Each outlet on the map was surrounded by a wavy 'isobar' line, signifying the trading area and showing any overlap between stations.

Another map showed Ottawa's main traffic arteries (present and future), heavy residential areas (present and future), big shopping centres, important traffic junctions and the main downtown area. It divided the city into six marketing segments, according to such topographical boundaries as rivers, canals, large parks, main roads or industrial areas.

Over this went a clear sheet of plastic with 28 circles on it. These were ideal service station sites, compiled from the voluminous research and without considering any existing stations. Some of the 'dream' sites were on main roads with shopping centres and/or thickly populated residential areas nearby. One was at the end of a bridge on Montreal Road, which funneled traffic in and out of downtown. No sites were in downtown–property values were too high there–but several ringed the business section to catch commuter traffic.

Next, the MPP squad visited each ideal location, in a car packed with background information. Here the dream was measured against reality. Was there too *much* traffic on the spot, making it dangerous or inconvenient for motorists to stop? If not, was the site available at a fair price? If not, where was the best available second choice? If an existing Esso station was on or near the ideal site, what had to be done to improve it? What would it cost? Was it worth it, or should the property be sold? The team made maps of each location, showing intersections, traffic lights, stop signs and potential service station entrances.

Then, back at the motor hotel, they argued the pros and cons of each site far into the night. 'Sometimes one of us would get so steamed up he'd stomp out, then have to get a cup of coffee to let his temper simmer down,' Holt says.

Finally their plan went to Imperial management for approval. It got it, and MPP took concrete form. The most visible result was the net reduction of active Esso stations in Ottawa and Hull from 43 to 34. Imperial built four new ones, completely rebuilt four others, modernized another 12 (by such means as adding a modern store front to an old square-box station) and made minor improvements to six others.

Thirteen stations were closed. One became a drive-in restaurant; another, a gospel church; a third, a coin laundry; another, a milk store; still another, a car rental company. One was leveled and the site became a park. The policy under MPP is to demolish the shut-down station if a non-petroleum buyer isn't found within a reasonable time.

Not one dealer lost his livelihood. A few were ready for retirement. Some were relocated in other communities. Most fitted into the improved facilities in Ottawa. A few even got private offices.

'Usually they said "I sure hope I'm part of this plan",' says Holt. 'They feel they're part of something new and dynamic.'

In fact, MPP raised the average Ottawa dealer's gross annual sales so greatly that his gross far outstripped that of an average Ontario druggist and came to about double the average hardware dealer's.

Reducing the number of stations didn't cut Imperial's share of the market. The share this year is expected to show a significant increase over the share the company had in 1962. The annual gallonage has more than doubled. Imperial's investment increased by 65 per cent and the company now pays the city 46 per cent more property tax money.

Ottawa also came out with distinct aesthetic gains. F.E. Ayers, chairman of the building appearance committee and director of planning and works, wrote Imperial's president a thank-you letter for 'the great improvement in design of what was once a rather sore point in the appearance of buildings at some of the most important street intersections.' Mayor Whitton, delighted with a streamlined Imperial gas bar (pumps but no indoor service facilities) at Laurier Avenue and Nicholas Street, hoped the design would be adopted in other parts of the city.

The Ottawa program is being periodically re-examined, which is standard MPP procedure. Meanwhile, MPP has spread from coast to coast with the same results. Everywhere motorists are better served while the profit to the dealer and the company are increased. Imperial's share of the market is increased while at the same time the total number of service stations is reduced. □

Former station at Bank and Carling Streets was closed, sold, and re-opened as a restaurant specializing in fried chicken

How Deep is the Ocean?

That depends on whether you're using the Welsh, Greek Common, Pythic, Roman, Saxon or Standard foot

Now what could be so difficult about setting up a system of weights and measures? You take a stick, a straight stick, cut a nick in it somewhere and say that represents a gorp. Don't lose it. Three gorps make a trebgorp, ten make a dekgorp and a thousand make a millegorp. Now take some water and pour it into a cup right up to the brim and you call that a gloup. Don't lose the cup. Three gloups is a trebgloup and so on. Decide that one gloup of water weighs exactly one gound and, yes, you get the idea. No arguments, no fuss. Just don't lose the stick or the cup.

Over the best part of 5,000 years a lot of different people have tried something like that; if not with gloups and gorps then with weys and stones, chains and angstroms, pecks and gills. The first standard of linear measurement is generally recognized as the cubit, defined as the distance from elbow to tip of middle finger. From it came the Egyptian Royal Cubit Master of 3000 B.C., a rod of black granite that was intended to endure for all time.

It didn't, of course. The black granite Royal Master has gone out the window along with a staggering succession of other attempts to standardize measurement. Today the world faces a whole conglomeration of measurements that vary from country to country. In some cases they vary even within countries; for example, Canada has two legal gallons, the Imperial gallon and the Canadian gallon. The difference is minute–just over a thousandth of a cubic inch. The Imperial gallon is 277.-419548 cu. in. and the Canadian gallon is 277.42068 cu. in. The Canadian gallon is legally defined by the Canadian Weights and Measures Act of 1951. The Imperial gallon is legally defined by the United Kingdom Weights and Measures Act of 1963. Both teams of legislators had the same gallon in mind, but the weighing specifications of one

varied slightly from those of the other. So we have two legal gallons.

If the Pharaohs had stayed in power we might have a single gallon today and a workable, universal system of measurement. The Pharaohs doled out death sentences to subjects who failed to bring in their cubit sticks for comparison with the Royal Master every full moon. That way a fairly sure standard of measurement was maintained through the Egyptian civilization. But then the Greeks conquered Egypt in 322 B.C. and set up a system of their own, incorporating some of the Egyptian rules of measurement. Then came the Romans and they did a bit more adjusting before marching off to conquer the rest of the known world. When the Roman Empire finally began to crumble it left behind much of the Roman measuring system in Europe to be incorporated into the newly emerging European civilization. The origin of the British system–for the most part the system we use in Canada –was influenced by the Phoenicians, Romans and Scandinavians. Indeed, it is so mixed up that even such an authority as W. J. Owen, Chief Inspector of the Weights and Measures Office, Bradford, England, feels it would be difficult to trace in detail.

All the measurement systems that developed in the early middle ages suffered from extreme parochialism. Without any effective means of communication with other communities, towns and villages went merrily along each doing its own thing. In general the medieval foot varied anywhere from 10 to 20 in. The acre was merely defined as the amount of land a man could plow in a day. An early 13th century contract issued from the Abbey of St. Victor in Paris shows that two parties found it necessary to agree on the length of the 'foot' they would use in measuring the land.

Medieval volumetric measures grew haphazardly from tubs, sacks, bundles and cartloads and all sorts of other terms. The ton, for example, began as a tun or tunne–Anglo-Saxon for tub–and was a unit equal to 252 wine gallons. That many wine gallons totaled approximately 2,000 lb. In Canada and the United States the even figure of 2,000 lb. is used for the ton, but the English make it 2,240, or 112 lb. per hundredweight to our 100 lb. per hundredweight. That's why the English ton is known on this continent as the long ton and our ton, when there's a chance of confusion, is called the short ton.

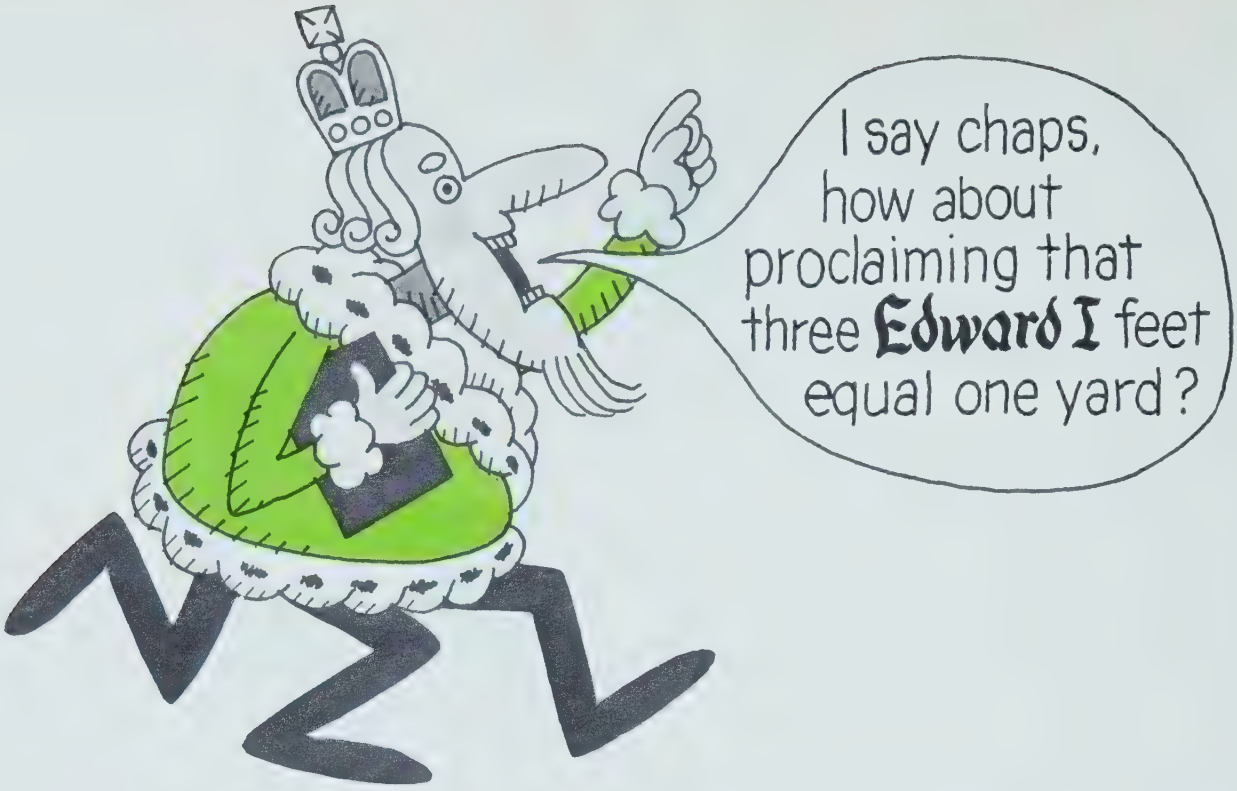
By the time Edward I came to the English throne in 1272 the measurement system was nightmarish. Take, for example, some of the variations of the foot that applied in England and Wales then. The Greek Common Foot of 12.45 in. was used for building. The Roman Foot of 11.65 in. was also used for building. The Natural or Pythic or Welsh Foot of 9.9 in. was used by the Celts in Wales for measuring land, but so was the Northern or Saxon Foot of 13.2 in.

Edward tried to tidy things up by declaring three barley corns round and dry to the inch and 12 in. to the foot. He had a brass rod marked off as a standard yard and it's still in the Westgate Museum of Winchester and differs only 0.04 in. from the present standard yard.

After a few changes by succeeding monarchs, the Imperial Standard Yard, made of bronze alloy, was legalized in 1855. Copies are kept at the Royal Mint, the Royal Society of London, the Royal Observatory and the Houses of Parliament. Though the workmanship is fine, this yard is not up to modern scientific standards because it can't be kept constant. The parliamentary copies have progressively shortened at an average rate of one part in a million in 30 years, possibly due to changes in the dimensions of the crystals in the metal structure.

But despite all the conquests and kings and changes, the yard today that is being split into angstroms (264 millionths of an inch) and expanded into light years (approximately six trillion miles) is a descendant of the first measurement ever recorded in history–the cubit. When the Greeks took over from the Egyptians they modified an Egyptian cubit to the Olympic cubit. Two thirds of the Olympic cubit became the Greek foot–and it measured

by Fred Annesley
illustrations by Bob White



12.16 in. The Romans divided the foot into 12 unciae. Edward I kept the 12-inches-to-the-foot idea and his three barley corn inches made up a foot that was barely distinguishable from the Greek foot. And three of these Edward I feet make the yard that is only .04 of an inch off that of today.

If we have these wavering, but nonetheless clear lines running right back to ancient Egypt, surely we might expect that the pattern could have been straightened out long before now. But no, we have tons and long tons and metric tons and U.S. gallons and Imperial gallons. There are acres and Cunningham acres and Irish acres and in Canada sections are legal measurement only in Manitoba, Alberta and Saskatchewan. In Quebec, a local unit of area is used called the arpent, equal to 0.845 of an acre. There are countries that use the metric system entirely; some use metric a little, but British mostly (Gambia); others use the British systems throughout except for the U.S. gallon (British Honduras). New Zealand uses the short ton for flour only and the long ton for everything else. The Ryukyu Islands use Japanese, metric, British and some U.S.

The Imperial system has been a long series of amendments. It seems as though nobody could bear to leave well enough alone because units of measurement were forever getting thrown out and replaced by new ones. This continual adjusting of the system is responsible for the current difference between Imperial and U.S. gallons. The U.S. gallon works out almost exactly to four fifths of the Imperial gallon and the difference causes a lot of calculating for trade crossing the border.

To avoid confusion, liquids being shipped across the Canada-United States border are usually calculated by weight. Imperial Oil, for example, sends oil by rail to the U.S. in pounds.

But a barrel of oil, not to be confused with a barrel of anything else, is standard throughout Canada. Though there are several barrels in existence for fruit and vegetables and for spirits, a barrel of oil is a barrel of oil–everywhere. It's 34.97 Imperial gallons and 42 U.S. gallons and that's the same amount of oil. The barrel isn't a legal measure, mind you, but it has grown from the relatively young–just over 100 years–oil industry and is accepted throughout it. The original volume was based on the amount of oil one man can roll in a barrel without too much strain.

The capacity of an oil well is usually gauged in barrels producible per day; i.e. 50 barrels a day is written 50 b/d. Clients for Canadian oil, whether they order it in long tons, short tons or metric tons, get the amount they order after the shipper has worked it out, but they receive their bills in barrels.

Just because the oil industry can boast a uniform barrel doesn't mean the business is without its confusing measurements. A stand of pipe, for instance, can be anything from 30 to 90 ft. A stand is the length of drill pipe that can be stood inside a drilling rig. A joint of pipe is 30 ft.; that's a single and that's as much as some derricks in Ontario can accommodate at one time. Some drills can pull doubles, as oilmen put it, and in Western Canada where the drilling is deep, the big rigs can pull trebles, or 90 ft. of pipe straight out of the ground before the top of the rig is reached and the pipe has to be disconnected to make way for the next stand.

The natural gas that so often is found with oil is measured in–well, it depends how you're talking about the gas. If it's gas in a reservoir that's being talked about, it's measured in so many thousands, millions, billions, or trillions of cubic feet, depending on the size of the reservoir. When the gas is being bought or sold it's measured in mcf–a thousand cubic feet. The buyer and seller usually have to get together and agree on how much for so many mcf at what pressure. The pressure is called psi, pounds per square inch, and gas is normally sold at around 14.25 psi which is atmospheric pressure at sea level. However, the psi is negotiable and if the buyer should insist on, say, 14.4 psi, he'd be getting a little more gas.

Special measurements for special needs confuse only the layman, but special measurements systems for special countries confuse everybody. Already, though, more than 90 per cent of the world's population has agreed

to end this confusion by adopting a system that has been around since the 18th century, is more accurate than the Imperial system, is simpler and is based on science rather than an Egyptian's elbow. It is, of course, the metric system.

The metric system became a reality with the tremendous social and political upheaval of the French Revolution. The men who led the Revolution were eager to disrupt the most ancient of European traditions, and the measurement systems were obvious targets. A decimal system of measurement units had been proposed as early as 1585 by the Flemish mathematician Simon Stevin. In 1793 the French National Assembly named the new unit of linear measurement the meter–meant to be one 10-millionth of the surface distance from the earth's equator to either pole.

The metric system is based on the decimal system so the counting is all in 10s, which makes the arithmetic easier. For multiples the Greek prefixes of deka for 10, hecto for 100 and kilo for 1,000 are used. For fractions the Latin prefixes are deci for 1/10th, centi for 1/100th and milli for 1/1,000th. The liquid measure is connected directly to the linear measure in that a liter is one cubic decimeter of water. That's it. But what about the problem of the permanent, indestructible standard? Even the surface of the earth won't remain constant.

That problem was finally solved in 1960 when the 11th International Conference on Weights and Measures settled on what scientists agreed was one of the most unchangeable standards known. They ruled that the meter shall be exactly 1,650,763.73 orange-red krypton wavelengths. Krypton is a gas that won't combine with anything else, so its orange-red wavelength is always the same. Since then the Imperial yard has been declared 0.9144 of a meter, a much more exact reference than any marked metal rod.

The metric system has spread throughout most countries of the non-English speaking world including the Soviet Union, China, India and all of Central and South America. The two major holdouts are the British Commonwealth and the United States.

Sentiment, say Englishmen Philip Rush and John O'Keefe in their authoritative outline *Weights and Measures*, has a lot to do with the British tardiness in accepting the metric system because of 'the British dislike of things "Frenchified", dating back from the days when Napoleon loomed over every English child's life as an ogre'.

Nevertheless the United Kingdom and the United States are preparing to adopt the metric system. Late in May, 1965, the British Government announced officially that it would begin a 10-year conversion to metric. In the United States an exhaustive five-year study for the Commerce Department has resulted in a bill calling for investigation of the adoption of metric.

Canada has taken no definite action as yet, but a subtle switch is going on here. Meat packages in supermarkets now are usually marked in decimals because a computer can figure out how much meat there is in a packinghouse much faster in 10ths of a pound than in 16ths. Gasoline pumps tick off gallons in 10ths too. It's not the metric system, but it's a start.

The metric system has been gratefully accepted by many out-patients of The Hospital for Sick Children in Toronto, one of the first hospitals on the continent to switch to metric. Dr. Peter C. Fleming, who chaired the committee that brought about the changeover in 1964, says that because Toronto has such a large European population, more out-patients understood kilograms than pounds.

Dr. Fleming reported the hospital made the change effortlessly and said the secret of a smooth change is to drop one system completely and move right into the other. 'Trying to keep both systems going for a while, with the intention of dropping one a little later, isn't the way to do it,' he says. Other Canadian hospitals have since followed the lead of The Hospital for Sick Children and Dr. Fleming believes a complete switch to metric in this country is inevitable.

'I really don't know what we're waiting for,' he says. □

WILD HORSES

20th century style

words Fred Annesley
pictures Ron Cole
John Orr, Charlie Huff

They're ridiculous, these little cars all done up in funny Mickey Mouse colors. Even without the colors they look ridiculous with their wee pod bodies slung low amongst four tall tires. So do the bigger sports racing cars, with their pure-form aerodynamic bodies. The cartoon colors though, Woody Woodpecker red and Tweetie Pie yellow and Superman blue, they really do something to a stranger at Mosport. It's like walking into fantasyland.

How's a stranger to this racing business–a person who gets all up tight when the needle on his old sedan bobs above 65–how's he supposed to think of these contraptions and their operators? The drivers of these cars are among the fastest drivers in the world. Those weird Indianapolis-type machines pack about 600 brake horsepower apiece. On a practice lap a driver can hit 178 m.p.h. on a straight–even a 4,000-ft. straight that ends in a series of tricky bends.

Sitting on the counter at one of the pit stops sucking on a Coke is a fresh-faced kid with a crew cut and clean white overalls. Beneath his dangling boots squats a black and gold racing car bearing the number four. That four means that the driver of that particular machine finished fourth last season in his class of the United States Automobile Club. The young fellow with the Coke is a mechanic. It's his job to care for this machine, surely one of the most pampered pieces of machinery on this continent. The stranger in this fantasyland stands there with his mouth open watching the young fellow checking wheel balance and coolant level and brake pressure. Then the young fellow helps a handsome driver who goes to a hair stylist get into the tight cockpit of the car. The driver takes a long time wriggling and grunting before he looks comfortable and then he and the young fellow set about adjusting the safety belts and the foot pedals; the driver frowns and smiles like a winetaster as the young fellow makes the adjustments. Then the young fellow starts the car by ramming a thing like a big electric drill into a hole in the tail of the car because Indianapolis-type cars dispense with a starter motor.

When the car starts it goes ZAP. The ZAP is just one decibel point quieter than the noise level necessary to burst a man's ear drums. The young fellow jiggles away at the accelerator lever on the motor as he makes the car go ZAP, ZAP, ZAP. The young fellow's smooth, sun-tanned face is totally relaxed as he listens and adjusts, listens and adjusts. It is the face of a man who knows exactly what he's doing.

In the morning the cars are rolled out for the qualifying laps. One at a time they take three laps each around the track, with the second lap timed officially. The first lap is always timed too, by the driver's team, and the time held up on a blackboard for him to see as he starts the second lap.

Sitting up above the pits is a nice-looking blonde. She has the soft lines of a mother. She leans over the railing to look down at the track and time the drivers with her stopwatch. That way she can tell how the other cars are doing compared with her husband's. Two little children, a boy and a girl, are sitting on tiny folding chairs near the nice-looking blonde's legs. They don't look up from their story books as the cars go by. Some of those cars are averaging as high as 102 m.p.h. around that twisty track.

Behind the stands, where some teams keep a spare $50,000 car in case something happens to the first, an enthusiast insists the stranger hasn't seen anything yet. Formula I cars can go round the track faster than Indianapolis cars (except you don't say faster in racing circles–it's quicker) and so can sports cars nowadays. The track record of one minute, twenty seconds and change for Mosport–Ontario's road-racing circuit near Toronto–is held by a specially built sports racing car.

The fierce spits and snarls of a highly tuned engine are exciting, it would seem, to the ears of a lot of Canadians. Last year, partly because of the country's birthday, Canada was chosen for a world championship Formula I Grand Prix. This, the first really major international motor racing event in Canada, drew a crowd of 40,000, which is 3,500 more than the country's next best-attended sports spectacle, the Grey Cup game of 1960.

More Grand Prix events in Canada and a very rapid increase in the popularity of motor sport are expected and are the reasons behind the appointment this year of the first paid full-time executive of Canadian Automobile Sport Clubs, the governing body of motor sports in Canada. Bob Hanna, who steps down as president of the Canadian Racing Drivers Association to take the new post of executive director of CASC, says every type of motor racing in Canada is expanding. He includes drag racing (straight line acceleration contests), late model stock car racing (standard cars with factory equipment only), modified stock car racing (they're stock in name only), imported sedan racing (hopped up Mini Minors and things), sports car racing (includes modified production sports cars and specially designed racing sports cars), Formula racing (single seaters with open wheels, built for road racing) and now Indy racing.

There are three major tracks for road racing in the country now: Westwood, near Vancouver; Le Circuit at St. Jovite; and Mosport, outside Toronto. Every province has at least one abandoned airport-type track and drag strips and stock car circuits are almost as common as skating rinks.

'As long as there are cars,' says Bob Hanna, 'there'll be men who'll want to risk their necks racing them.'

The stranger slips behind the wheel of his sedan and winks casually at a pit popsie in stretch pants. He heads down the highway for home, at nearly 70. □

Fed by four twin carburetors like those on the Lola-Chevrolet at top, a sports racing car like the McLaren driven by John Cordts, of Barrie, Ont., (left) can exceed 200 m.p.h. The fat wheels on the BRM Formula I driven by Jackie Stewart (right) are for traction; the rear tires are a foot wide where their tread touches the road — at their widest dimension they measure 15½ inches; the widest family-car tire is just under 8½ in. at the bulge.

The wheels on a racing car aren't ordinary wheels. The Lola-Chev steering wheel at top is upholstered in leather over foam to give the driver a good grip. Its spokes are a springy aluminum alloy — a safety measure. The wheel above is an alloy, too — strong, light magnesium. The vista at right is what you see through the access holes when two McLaren Mark III's are lined up with their engine covers raised to let their mechanics get at the engines. At lower right is the front end of John Surtees' Lola; the opening provides ventilation for the radiator

Not only must the paint be faultless on a car like Jim Hurtubise's Ford-powered Indianapolis car at left, but even the exhaust pipes have to be in tune; the pipes in the spaghetti-like tangle at lower left are all hand-made, and each is formed to vent its gases as effortlessly as ingenuity can devise. The adjustable wing on Sam Posey's Hudson Wire-Caldwell Special, below, works like an airplane wing, only in reverse — it can be tipped to press the car down, giving the wheels better traction for cornering and sudden acceleration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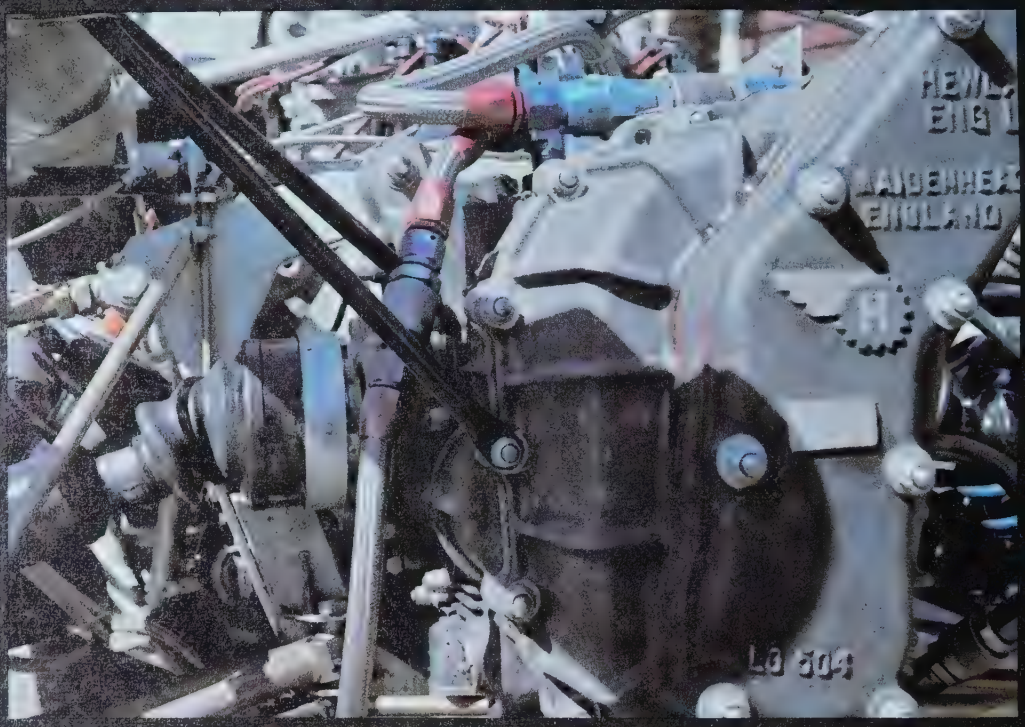

L8 804

The rockets at left are the exhaust pipes of an Indianapolis car, and under their chromed support is the cover of the hole for the starter engine. The sturdy mirror support at the top of the pages is on a Lola; it's pierced for lightness, but it has to withstand wind speeds as great as 200 m.p.h. On the opposite page, from the top, are the radiator air scoop for the BRM Formula I driven by Mike Spence last year at Mosport; the gear housing, clutch bell housing, rear suspension, and drive shafts of a sports racing car, all whistling clean as per regulations; and the glowing orange front fender of a McLaren M6A sports racing car

The big storm of 1954 gave Toronto a flood control plan

The Legacy

by Robert Collins

Heart Lake's 375-acres 35 miles from downtown Toronto can accommodate 5,500 people at a time. It is one of 12 such areas close to the city

color photos: MTRCA

and the plan gave Torontonians a unique series of parks

of Hurricane Hazel

The smothering hand of the heat wave fell over Toronto on Thursday, June 23, 1966. It had all the familiar misery of a thousand other heat waves. By mid-afternoon the temperature was 91; by midnight, still around 80. On Friday and Saturday it reached 91 again. The humidex (measurement of heat plus humidity) was 100; 85 is rated uncomfortable. Sunday was 94 with a humidex of 103.

It was the kind of weather when babies wail all night, old men drop dead in rooming houses, tempers hang by threads and the surest way to sanity is out of the city. For people with no summer cottages, there once was little escape. This time there was.

When the week and the heat wave ended, a record-breaking 128,000 Torontonians had fled north to 12 clean, grassy, watery bits of heaven-on-earth, no more than an hour's drive from downtown. For 50¢ a carload (since raised to $1) the heat wave refugees swam, fished, boated, picnicked or just flopped under trees, for a day at a time, on wildlife preserves, reforestation projects or emergency floodways.

None of the 12 'parks' was really a park at all. They were, and are, properties of the Metropolitan Toronto and Region Conservation Authority, primarily designed to conserve natural resources. But to those who set that all-time one-week attendance record for conservation areas, or the 1,142,000 people who used the areas in 1967, it's all a matter of semantics. To Torontonians, as to most other Ontarians, conservation means recreation.

The Metropolitan Toronto and Region Conservation Authority (MTRCA) is one of 36 conservation authorities in Ontario, a partnership of local, provincial and federal governments that is unique in Canada. In each, the prime concern is flood control, water conservation, forestry, land use and fish and wildlife management. In MTRCA, nesting boxes for rarely-seen wood ducks and nearly-extinct bluebirds are placed in conservation areas. Plots of mixed grain and aquatic plants are grown to provide extra food. Lakes, ponds and streams are restocked with bass and trout. About 150,000 shrubs have been planted as wildlife food and cover.

Since much of the land around headwaters is owned by private citizens, MTRCA has planted five million trees on private property as well as reforesting its own land. The trees form a cover that retards runoff and helps control floods. The authority also encourages proper land usage–such as strip cropping, or lining river banks with stone at erosion points –on private as well as authority property. And the ponds and dams that control water in time of flood also provide water for livestock, wildlife, swimming or boating during the rest of the year.

But the authorities also include 102 conservation areas open to the public. This means that a flood plain, when not controlling runaway waters, makes a perfect picnic ground. A reforestation project can double for hiking and camping. A dam to curb an unruly river will also serve boaters and swimmers. And what better place for nature trails than a wildlife preserve? (MTRCA even has *do-it-yourself* nature trails, with individual guidebooks keyed to numbered points of interest.)

In other parts of Canada recreation is also a fringe benefit of conservation. For example, the South Saskatchewan River Dam–primarily a conservation and irrigation project–has created a resort lake in the middle of the prairie. But nowhere else does the conservation and recreation initiative lie in the hands of municipal governments. In Ontario the onus is on them to conceive projects which, the theory says, means they get the exact facilities they need while having access to funds and technical advice from senior governments.

The conservation authority idea may thus be a dramatic answer to the recreation crisis. And nowhere has it been more sternly tested than around Metropolitan Toronto. This region has some of the trickiest flood problems and *the* fastest growing urban centre in Canada: two million people now, an estimated four million by the year 2000. MTRCA's job, in simplest terms, is to save natural resources from the galloping metropolis and save playgrounds for the ever-increasing human hordes with their ever-increasing leisure time.

Fifty years ago the words 'leisure', 'recreation' or 'conservation' had little real meaning for the average man. But by the 1930s even the most shortsighted layman could see that Canadians were methodically depriving themselves of their outdoors. Forests had fallen to farmers and developers. Rivers were mere trickles each summer and torrents each spring. Pollution from pioneer mills and 20th century factories had killed or driven off the fish. Birds and animals were retreating with the forest. Cities like Toronto, with their satellites, were gulping acres of rural land.

A depression and a war temporarily shelved conservation. Then in 1945 Ontario's Conservation Authorities Act was passed, establishing three principles: a unit of conservation would be the watershed, the provincial government would offer aid and advice, initiative for action would come from local communities.

Four separate authorities were promptly formed around Toronto. There was much to do. The base of this fan-shaped region–the city proper–lies in the hand of Lake Ontario. From there it spreads and rises north, northeast and northwest, through rippling hills, timber thickets and sharp riverbeds. There are nine distinct watersheds in the area. One, the Humber River, drops 1,200 ft. in 58 miles.

Many people lived on the flood plains in the late 40s, menaced each spring by racing waters, ice floes and shattered bridges. The conservationists accordingly set out to control the headwaters of each stream. Soon they realized that small individual efforts wouldn't work. This massive task had to be met with massed funds and planning. It took the greatest natural disaster in Toronto's history to drive the point home.

In October, 1954, a hurricane called Hazel marched up North America's eastern seaboard. Meteorologists watched closely as it smashed and killed its way toward Toronto. Early on October 15 they issued 'extremely drastic' storm warnings, with accurate forecasts of 60-70 m.p.h. winds and 'drenching rains'. But there was no way of predicting how *much* rain within a given period. Anyway, hurricanes were totally beyond public comprehension. The worst previous storm in Toronto history was a downpour that flooded much of the country, stopped trains and washed out a Grand Trunk Railway bridge at Black Creek, north of the city. But that was in 1878, so few people took special precautions in 1954.

It turned out to be the biggest concentrated rainfall the district ever had: 9¼ in. over 24 hours which, someone calculated, was around 322 million tons. By evening the swollen Humber and Don rivers, lashed by the wind, went on the rampage. Other rivers and creeks jumped their banks. A wall of water began to converge from the northwest. Entire communities were marooned. The floods moved in terrible leaps, sometimes temporarily halted by bridges, only to build up force, tear the bridges out and carry them on like battering rams. Whole houses were swept away.

Eighty-one people died that night. Some clung to roofs, floating debris or trees, and lived. Police, firemen and volunteers did what they could, sometimes dying in the attempt. Hazel left a horrible rubble of rocks, concrete, trees and mud. Part of an entire street in suburban Etobicoke was wiped out, with 31 deaths. Total property damage exceeded $25 million.

After that nobody needed to be sold on concerted flood control. In February, 1957, four existing conservation authorities were

The aims were, and still are, conservation and flood control, but to the people in the Toronto region, the greatest achievement has been the creation of a series of parks

melded into MTRCA: 1,000 square miles embracing part or all of 23 municipalities and a tenth of Canada's population. Fifty-two of the 55-member board are appointees of those municipalities. The chairman and two other members are appointed by the province. They set policy, approve projects and help raise funds.

As the participants soon discovered, conservation is costly: $39 million in the first 10 years. Much of the money comes, one way or another, from taxpayers. Each municipality pays a per capita levy of about 43¢. The province pays grants for general conservation work. For major flood control, the municipalities, province and federal government all chip in.

To maintain its recreational areas, MTRCA charges 50¢ (winter) and $1 (summer) admission fees per car, with no limit on the number of passengers. There are extra fees for group camping, boat rental, ski tows or snowmobiling. As well, the Conservation Foundation seeks donations from business and individuals for special projects.

One of these special projects is the 18-building Black Creek Pioneer Village, a capsule of living history. Here 150,000 visitors a year sniff fresh home-baked bread; watch the blacksmith, harness maker and candle molder at work; explore grist mill, school, general store and homes of the 1793-1867 period.

Foundation funds, to which Imperial Oil contributed, also built the Albion Hills conservation school. Year around–in its fields, forests, working farm and handsome stone-and-timber building–the school shows its students how to appreciate and preserve nature. They study the area's soil, forests, water and wildlife and how these elements are conserved; they study the relationship between the land and the way people who live on it use it; and the relationships between country and city. They work on the farm; learn how to draw maps and read charts; go on wildlife field trips into the outdoors. They develop a respect and sympathy for nature and, hopefully, learn more about working and cooperating with each other.

Most students are secondary school pupils who live in for a five-day or weekend course. Every year the school gets enough applications for two years. And at the end of nearly every course a teenage girl or two weeps at having to leave the wonder and revelations of Albion Hills' outdoor world.

Important though these educational projects are, MTRCA's prime interest has always been basic conservation. In 1959, with Hurricane Hazel a fresh and ugly memory, MTRCA tabled a $38 million flood control plan. It involved buying flood plain land, building channel improvements where such land was too expensive and building 13 dams and reservoirs. By rights that 10-year plan should be nearly completed now; in fact, it may take another 10 years and double the money. The reasons: land and construction costs.

Although the authority can expropriate land, individual owners are protected by an intricate system of safeguards, including professional appraisals of every potential purchase. And property values have grown beyond the planners' wildest nightmares. Land that would have sold for $50 an acre 10 years ago now costs $400-$500. For one vital half-acre MTRCA had to pay $36,000.

Nevertheless the authority has assembled 18,000 acres and is satisfied with its progress. 'We have something that really works,' says director of operations Kenneth Higgs, a professional forester, who heads a staff that ranges from 150 to 250, depending on season. The $26 million so far spent on flood control has produced a dam and many channel improvements. New bridges have gone up. Dwellings have been cleared from the flood plains. MTRCA, empowered by law to prevent dumping of waste in watershed valleys, enforces the rule with monthly helicopter checks. A network of rainfall, snowfall and stream flow gauges, combined with more sophisticated weather forecasting, has produced an excellent flood warning system. Toronto could now weather the worst of a Hurricane Hazel and by 1980 will be safe from anything short of a Biblical flood.

Every year, though, MTRCA is awash in a tidal wave of people. The demand for recreation space still staggers most officials. In 1957

the combined authority inherited three conservation areas from its predecessors and began a modest improvement program.

'We opened the Heart Lake area just northwest of Toronto, for swimming in 1957,' remembers MTRCA staff man Bill McLean, who has an MA in resources management. 'We had parking space for 250 cars. On the first Sunday 600 showed up. Right then we realized we were out of our depth.'

Since then, through harsh experience and many surveys, MTRCA has learned how to conserve another natural resource–people–from the onslaughts of the city. Its 12 recreational areas–ranging in size from 50-acre Humber Trails to 995-acre Boyd, and each capitalizing on its particular terrain–satisfies just about every taste.

You can hike or picnic in all 12 areas; fish, group-camp or follow a nature trail in eight; swim in five. At the Heart Lake area–375 acres with a jewel of water nestled in steep hills–boating is an added attraction. Cold Creek, in relatively open country, specializes in archery, trap and rifle shooting; it also has a lovely mucky bog for weekend botanists. The 271-acre Bruce's Mill area includes a 19th century grist and flour mill, now being renovated. MTRCA even owns a $1 million art collection that includes many Group of Seven paintings on a 40-acre rural property, donated by Robert McMichael, a Toronto businessman.

But with each new area or improvement, more outdoors addicts come breathing hotly down MTRCA's neck. By noon on many summer Sundays the Boyd and Heart Lake areas are choked with 1,100 cars carrying, by MTRCA's survey counts, about 5,000 people. That's all the beaches and lifeguards can handle; latecomers are turned away. Whereas in 1947 one of the original small authorities visualized a maximum recreation demand of 14,000 people a year, the Albion Hills area now gets nearly that many on a weekend.

Three years ago MTRCA introduced sunrise hikes, with a naturalist, forester or geologist as guide. One hundred people were expected on the first morning; 350 showed up. Even on a bitter winter day, 250 ardent hikers will turn out for four-mile jaunts. MTRCA's winter program also draws about 30,000 skiers, skaters, snowshoers, picnickers, tobogganers and snowmobilers every month.

Such data, plus 'curve-demand' maps showing how many people come from what distances, helps MTRCA plan more efficient new areas. Parking, picnic and beach facilities are thus made compact and adequate with no need for expensive piecemeal additions. Bruce's Mill, one of the newest areas, costs only 19¢ a person to operate; Albion Hills, one of the oldest, costs 25¢.

With wise planning and more land MTRCA hopes to stay a jump ahead of the 3½ million visitors per year it expects by 1980. By then it will have 34,000 acres. Its recreation facilities will then include the 1,600-acre Claireville area, which will handle 18,000 people per day. Already Claireville's new flood control dam on the Humber River has created a 1½-mile lake, part of which will be opened for recreation in 1969.

If the land runs out there's still Toronto's lakefront–a vast and largely undeveloped area, the subject of grandiose dreams but no coordinated plans. MTRCA people would like to see the regional conservation technique applied here too.

'One way or another,' says Kenneth Higgs, 'we think we can meet recreation needs beyond the year 2000.'

Which is a prediction few other communities can make. Last fall Prince Philip told a meeting of Canadian naturalists in Toronto: 'Conservation is a case of now or never . . . I, for one, do not relish the idea of my grandchildren asking me, "What went wrong?" . . .'

If MTRCA has its way, Toronto's grandchildren won't have to ask. □

Toronto Telegram

Hurricane Hazel's 1954 flood killed 81 people. Conservation measures would control it today

Grow-Power

Engro fertilizers are rejuvenating tired prairie soils

Farmers in Canada are busy shoring up a myth that white-fingered poets started long ago about the good earth being bountiful and all-providing. The men who get their hands into the soil know the good earth doesn't deliver much bounty unassisted. In fact from the first year a crop is taken from it, a field starts to lose growing power. Each crop mines plant nutrients from the soil. Unless these nutrients are replaced the crop yield will drop. Farmers in Canada keep themselves in business, and the poets honest, by pumping nutrients back into tired soil, or otherwise barren soil, at the rate of two million tons a year.

The nutrients are in chemical fertilizer and right now the sales figures for the stuff are growing like the plants that are sprouting from the souped-up soil. Since 1960 the use of chemical fertilizer in Western Canada has been increasing at an average rate of 25 per cent per year. In Eastern Canada, where fertilizers have been in use for a longer time, the increase averages about five per cent.

But in the west chemical fertilizers are new, and their use has shot up by 30 per cent in 1967. They're expected to go a lot higher too. Right now only about 50 per cent of Western Canada's 84 million acres of farmland have been treated with fertilizer–chemical fertilizer that can, in the case of poor soil, pay for itself as much as five times over in one crop. Fertilizer market forecasters expect that percentage eventually to rise above 80 per cent. They also expect the current average application of 25 lb. of fertilizer per acre to more than double. On top of which they expect–just as long as there's plenty of demand for Canadian wheat around the world–an increase of 15 to 20 million acres in the amount of land tilled by prairie farmers in the next 20 years. This increased acreage will come about both through the clearing of wilderness and a lessening in the practice of letting certain fields lie fallow for a year.

The use of chemical fertilizers is growing fast now, but it was a long time coming. Man was using fertilizer to increase crop yields long before he knew anything about the chemistry involved. The first fertilizer was organic; a direct product of living things, such as animal droppings or carcasses. This organic matter serves as food for microorganisms already in the soil and is also often rich in powerful plant nutrients. Nitrogen and phosphorus, before chemical fertilizer, came mostly from animals, by way of manure and bones.

Centuries before the word fertilizer ever figured in farming, men were burying wood ash in their soil. This, though they didn't know it, gave essential potassium to the plants.

When the first settlers came to North America they found the Indians increasing their grain yields by planting fish with the seed. Medieval farmers in Europe had already developed the practice of growing nitrogen-converting legumes like clover and plowing them back into the soil for fertility. By the early 19th century, bones, green manure (like the clover), farm manure, blood and animal wastes were widely used, if not understood. Today fertilizer from plants and animals is still used and can still produce excellent results. However, getting green fertilizer involves time and acreage, and most farms don't have enough manure to go around. But an even greater limitation with both of them is that they prevent the farmer from getting the exact balance of nutrients he may need for a particular patch of land. True, he can get a much different mixture of nutrients from poultry manure than he'll get from cow manure, but only chemical fertilizers can be custom-mixed to give him the nutrients he needs in the exact proportions he requires.

The chemical fertilizers available today have developed slowly out of the information man has pieced together–almost all of it in the last 100 years–on how a plant grows.

The growing plant needs up to 16 nutrients. It gets three–carbon, hydrogen and oxygen–from the air and depends on the soil for the rest. Where the soil doesn't have enough of the others the plant will grow poorly or it won't grow at all.

Enormous laminated wood beams joined in pairs will roof 360-by-120 ft. storage building

Ron Cole

Fertilizer plant rising near Redwater covers 280 acres and will have 24 major buildings. More than 350 men are working on the project

Of these soil nutrients the three most important are nitrogen, phosphorus and potassium, but plants also need sulfur, calcium and magnesium. Traces of boron, copper, iron, manganese, molybdenum, zinc and chlorine are essential too, and these are sometimes added to fertilizers. But the big three in fertilizer is N, P and K–the universal chemical symbols for nitrogen, phosphorus and potassium.

Today the nitrogen comes from synthesized ammonia, through a process discovered by a German chemist, Fritz Haber, who in 1910 succeeded in synthesizing ammonia by combining hydrogen with nitrogen. In 1913 Haber set up a plant that could produce 20 tons of ammonia a day. Two world wars greatly increased the production of ammonium nitrate for explosives. Many of these ammonium nitrate plants later switched to producing ammonia for agricultural use.

The phosphate fertilizers were developed in England by a wealthy farmer named John Bennett Laws who, acting on the thesis of German chemist Justus von Liebeg that the action of sulfuric acid on bones produced phosphorus that could be used to fertilize plants, took out a patent in 1842 to make a phosphorus-containing fertilizer. Near the turn of the century phosphate-rich slag from iron and steel mills became a major source of fertilizer in Britain. Phosphate fertilizers now come from phosphate rocks, which are really concentrations of the minerals that supply phosphate to the soil.

Potassium, or potash, is generally no problem in Western Canada. Fertilizers destined for prairie markets need very little of it because there is usually enough in the soil. Indeed there are vast deposits of it in Saskatchewan and Manitoba, at depths ranging from 3,500 to 12,000 ft.

Nitrogen speeds plant growth and livens up soil bacteria. Phosphorus hastens seed germination and the formation of roots. Potassium beefs up the plant's resistance to frost and disease. Put them all together, they spell money.

A chemical fertilizer representative will tell a prairie farmer these days that if he buys his fertilizer and applies it properly he'll make three dollars for every one dollar he spends on the fertilizer.

'Certainly,' says C. M. Webber, of the agricultural chemical sales division in Imperial's marketing department. 'Three dollars is quite a safe figure.'

To a farmer with poor soil this three-for-one offer is pretty conservative. A field with a light yield gives the right fertilizer the opportunity to cut loose and bring in extra

Roy Nicholls

Fertilizers will restore the fertility that prevailed when the prairies were settled around 1900 and wheat ran 20 bushels an acre

grain worth as much as five times the cost of the material. Where a farmer's got a fairly good yield, the fertilizer can't do quite as much for him. But if he's been getting good crops without fertilizer, he'll get better crops with it.

With all this power being spread around in recent years it might be supposed that prairie yields these days are enormous. In fact they haven't improved much in more than half a century. Chemical fertilizer is just now helping to bring back the yields that were commonplace on the prairies in 1900. At the turn of the century the rich land of Western Canada, nurtured by the growing and dying of thousands of crops of uncut grass, could produce 20 bushels of wheat per acre comfortably. But the wheat farmer began to take nutrients out of the soil through his crops and didn't replace them. Precious topsoil was lost through misguided farming practices, like burning off stubble that could have anchored the soil against the wind. Pests and weeds reduced the yields too. By 1930 an average yield on the prairies was 15 bushels per acre. Now it's back up to 20 plus.

'Chemical fertilizers certainly can't take all the credit,' says Laurence Muir, of the agricultural chemicals division of Imperial's chemical products department, 'but they've played an important part in bringing the yield back up again. Other important factors have been developments in herbicides and insecticides.'

The market has had its effect too. The years between the end of World War II and 1960 were a period of wheat surplus, and prairie farmers saw little point in stepping up grain yields–from 1952 on they were producing more grain than they could sell. Then in 1960 new markets overseas were opened up, among them Red China, and suddenly the farmer found he could sell every bushel he could grow.

'To do this he has not only been buying more fertilizer,' says Morley Handford, agricultural chemicals manager of Imperial's marketing department. 'He's been using land he never used before. If he had no open land to expand his farm, he went out and cut down some brush he hadn't thought of clearing before.'

And even though 1967 wheat sales have declined, the long-run prospects seem favorable. A private survey recently predicted that the annual potential market for wheat in the next 10 years will be about 625 million bushels, and that it could become significantly bigger if large scale international attempts are made to solve the world food shortage.

Fertilizer is also cutting down on summerfallowing. The practice of planting nothing in the field for a year conserves moisture, replenishes the nitrogen and controls weeds by

Engro warehouse at Stony Plain, Alta., is one of a chain of 400 that serve the prairies and the Peace River area

letting them sprout and grow until the farmer destroys them by plowing them back into the soil. Today, he can keep his fields producing crops steadily, controlling the weeds with highly selective herbicides and putting the pep back into his soil with chemical fertilizers.

The increasing importance of fertilizer is behind one of the largest single investments Imperial has ever made. The company is currently spending more than $60 million putting itself into the chemical fertilizer manufacturing and marketing business. Since 1964 Imperial has been selling a full range of fertilizers under the brand name of Engro through specially-trained Esso agents across Western Canada. The company has recently completed building a $7 million network of some 400 fertilizer warehouses across the three prairie provinces so that fertilizer can be delivered promptly to the prairie farmer, wherever he is, as soon as he needs it. In 1966 the company announced it would build a fertilizer complex seven miles south of Redwater, Alta. Work is already well under way on the new plants and production will begin in 1969.

Imperial is in the fertilizer business right now, and has been since 1964, when it began marketing Engro fertilizers in the three prairie provinces and the Peace River district of British Columbia. As the market grew Imperial hired trained agronomists (there are now 14 on staff) whose job is to instruct Imperial's 550 Engro agents in the technical aspects of fertilizer use and to train them to take soil samples for analysis in provincial university laboratories. Their responsibilities also keep them out on the land where they talk to leading farmers, translating the university-analyzed soil samples into recommendations for fertilizer requirements. The agronomists also advise the farmer on cultivation, seeding practices, herbicide needs and other ways to increase his yields. They conduct clinics on farm problems, hold field days to demonstrate the results of fertilizer use, and participate in provincial department of agriculture extension training.

Since 1965 Imperial agronomists have held two training courses for prairie fertilizer agents. The first, a three-day seminar held for groups of about 20 each in more than a score of western cities, answered basic questions about cultivating and fertilizing practices, and provided instruction in selling fertilizer. The second, a four-day course, is equally divided between fertilizers and herbicides.

To the farmers themselves Imperial has distributed 75,000 copies of a handbook containing basic information about fertilizers, and the company also makes available quarterly bulletins containing detailed information on the most up-to-date fertilizer practices. Four were sent out in 1967 and four more will go out this year.

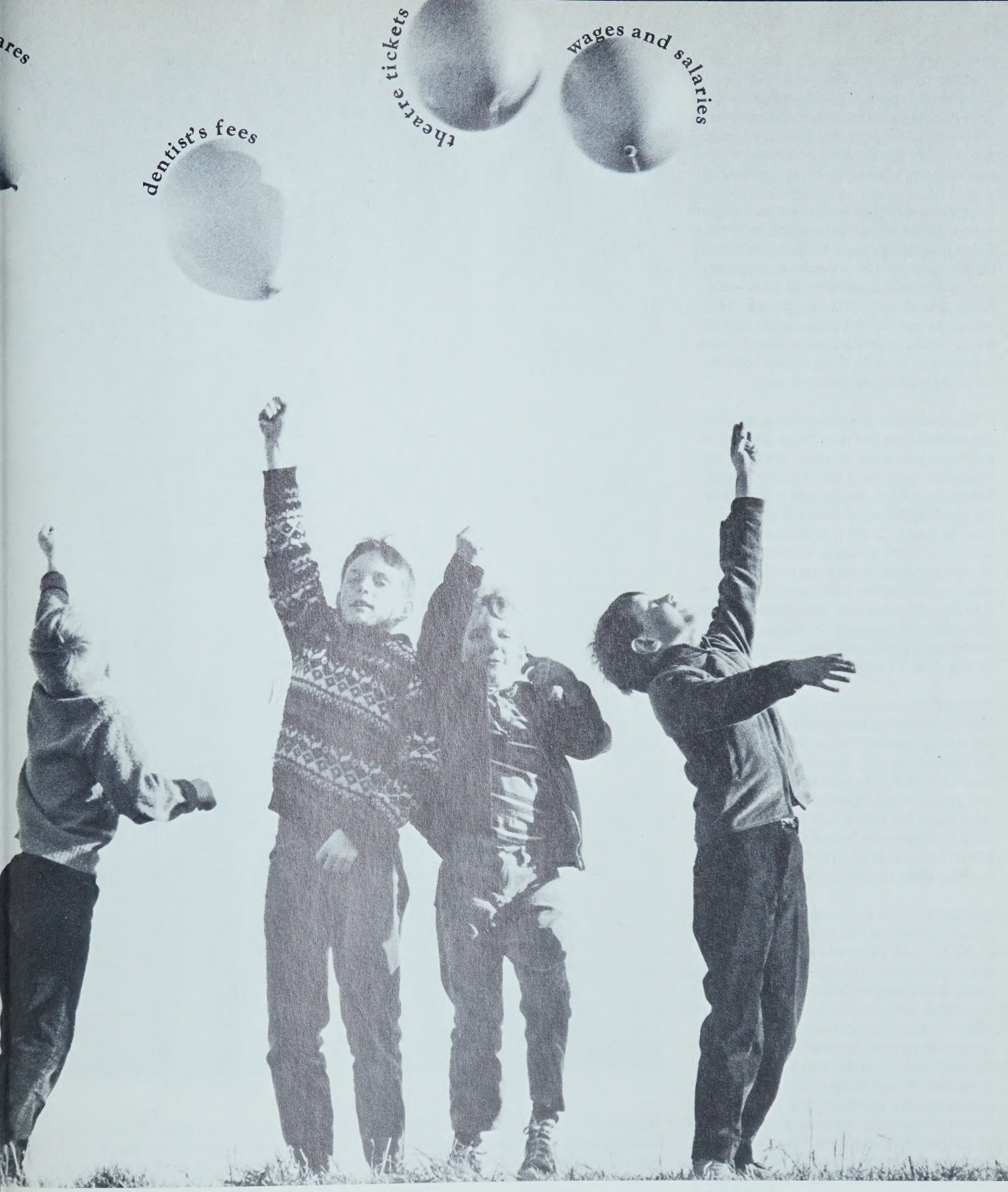
But what is Imperial doing in fertilizer anyway? 'It was actually a case of discovering the fact that a big market was developing,' explained marketing's Morley Handford, 'and recognizing that our existing network of Imperial Esso agents was ideally situated to distribute the products the developing market needed.' With the need for fertilizer clearly demonstrated and the means of marketing it already in existence, the logical final step was to begin manufacturing it.

Behind the cool business decision based on that reasoning lies a fact of great importance to Canada's economy. A survey conducted for Imperial indicates that fertilizer use in the future in Canada will help increase the average Canadian wheat crop by 47 per cent. A 47 per cent increase in last year's 595-million bushel Canadian wheat crop, sold overseas at an average of $2 a bushel, would have earned this country $560 million. □

What's up?

photo: Ron Cole

Everything in the Dominion Bureau of Statistics price index but fuel oil, household appliances, eggs and poultry. Food's up. It costs $1.49 to buy what a dollar would get you in 1949. Fresh vegetables last December cost more than 60 per cent more than in 1949–the year on which most price indices are based–and fruit 56 per cent more. If you drive to the store to buy them, the gasoline you use to get you there will have gone up, too, but not by anything approaching the rise in food costs: the amount of gasoline you could buy for a dollar in 1949 cost nearly $1.16 last December, mainly due to taxes. Mind you, it was far better gasoline–the research octane rating for regular grade was 94.6 last July. In



1949 the octane rating was 81.1.

Wages and salaries are up. The average weekly wage in Canada now is nearly two and a half times as big as it was in 1949. While wages were rising at that rate, know how much the combined price of regular and premium gasoline increased? Only 15.8 per cent.

It costs more to get around these days. Taxi fares are half as much again as they were 20 years ago, and street car and bus fares cost nearly three times as much. The cost of driving your car is up by a third, reflecting increases in the cost of the car itself, its tires, insurance, fender replacement, brake relinings, batteries and gasoline. But the cost of gasoline has gone up less than any other component except batteries, and as the other components continue to rise, gasoline accounts for a smaller and smaller percentage of the car's operating costs. The wholesale price of gasoline–that is, without the dealer's markup and the provincial road taxes–represents 12 per cent of the car's operating cost.

Oddly enough, vitamins and prescriptions cost less in 1967 than they did in 1949, but in the classification of health and personal care, they're the only items that dropped. The index for doctors' fees went up 85 per cent, dentists' fees more than doubled and extractions cost almost 2¾ times as much.

Recreation and reading showed the same inevitable rise. What cost a dollar in 1949, generally speaking, cost $1.70 in 1967. The biggest increase was in theatre tickets. They cost nearly three times as much last December as they did in 1949. Last spring a Toronto movie theater was charging–*and getting*–$5 a ticket. Newspapers have more than doubled in price, and since 1957 the cost of advertising in them has gone up 60 per cent.

While these items have been rising, gasoline prices have risen less than 20 per cent–all of it in taxes and dealer markup. Actually, the oil companies are getting less. To use Imperial Oil as an example, the amount it got out of the gasoline dollar has been going down, from 49.8 cents in 1957, to 41.3 cents in January of 1967, an actual *drop* of 8.5 cents. At the same time, the federal government raised its take of the dollar from 3.5 cents to 4.8 cents, the provincial governments raised theirs from 28.4 cents to 33.9 cents, and the service station operator's share went up from 18.3 cents to 20 cents.

While this has been going on, the cost of refineries, service stations and drilling oil wells has been rising like theater tickets. If you divide all the money spent in 1966 to find and develop wells by the number of wells drilled, you get a per-well figure of $622,000. The same figure for 1946 is only $300,000. Since 1946, in fact, the oil industry has spent $8.5 billion exploring for, developing, producing and operating oil and gas fields.

Refinery costs have gone up, too. To build a refinery today costs between $1,150 and $1,200 for each barrel of daily capacity; 20 years ago it cost only $900. As for marketing, here's an example of how costs have shot up: A two-bay service station costs about $75,000 today. Twenty-five years ago it was $18,000. An automotive service centre with a diagnostic clinic can cost as much as $1,000,000.
In the face of such figures, how is it gasoline sells as cheaply as it does? The main reason is the intense competition among oil companies for the motorist's business. Competition keeps the price so low that the oil companies have had to seek every means of keeping their costs down and increasing their productivity. By making better use of its resources through research programs and the constant modernization of techniques and equipment, Imperial Oil is able to do more with a dollar today than it could do in 1949. For example, by using computers the oil industry can speed up enormously the work of interpreting seismic data. By developing new criteria for the spacing of producing wells it has reduced the number of wells that must be drilled to recover the maximum amount of oil. By researching new methods of recovering oil it has greatly increased the amount that can be gleaned from a discovery. By designing better ships and more efficient pipeline equipment it has offset the rising costs of transporting oil. By making use of every advance in refinery technology and construction techniques, it has been able to offset a large part of the enormous increases in the cost of labor and materials. Such advances are products of the limitless human imagination, and there is no reason to expect that man's resourcefulness will suddenly dry up. But it is also true that innovation comes in spurts, rather than in a steady, dependable, predictable stream. There comes a time when the steadily-mounting pressure of rising costs overtakes the cost-cutting techniques of the day, and prices must rise. That's the time to look back at the price of gasoline and wonder how it could stay so low so long when the price of practically everything else was spiraling upward. □

Belts give the best figures

A study of almost 30,000 traffic accidents in Sweden demonstrates that safety belts in cars really work. The survey–by Volvo–showed that of 6,870 drivers using lap and shoulder belts, two were killed and 226 injured. The number of drivers not using belts was 21,910–more than three times the number using them–and the fatalities among them amounted to 37–more than *six times* the fatality rate of the belted drivers. The number of front seat passengers killed or injured was also higher among those who did not wear belts than among those who did. Another finding: use of a combined shoulder-lap belt reduced severe skull damage and facial injuries for both drivers and passengers. Do seat belts *cause* injuries? Of the 28,780 accidents studied, safety belts caused 34 injuries to drivers, and 25 to front seat passengers; most were minor injuries.

Chemistry's top ten

The 10 outstanding achievements of chemical engineering have been picked by the American Institute of Chemical Engineers. The 'top 10': commercial synthesis of ammonia; production of antibiotics; establishing the plastics industry; producing fissionable isotopes; producing petrochemicals; establishing the synthetic fibers industry; electrolytic production of aluminum; establishing the synthetic rubber industry; producing chemical fertilizers; and developing high-octane gasoline.

The homey touch

The latest thing for the well-equipped heliport might be a 'broadloom' landing pad. Such a pad, 120 ft. in diameter and one-quarter inch thick, has been developed for the U.S. Air Force. Made of chlorinated polyester resins reinforced with glass, it eliminates the clouds of sand and dust raised by the rotors and shows only surface scratches and skid marks after takeoffs and landings by helicopters weighing up to 31,000 lb. A similar resin has been used to make a road over sand dunes. Both the landing pad and the road were poured on unprepared ground.

Increasing oil production

Oil production in Canada last year jumped 10.8 per cent ahead of the total output of 1966, reflecting the dislocation of supplies caused by the Arab-Israeli war. Overall world production showed a 6.7 per cent gain. Despite a civil war in Nigeria and the pipeline shutdown in the Arab countries following the war with Israel, the free world gained by 7 per cent. Communist countries showed a 5.7 per cent gain. Reserves also increased. The free world had 378.6 billion barrels and the communist nations had 35 billion barrels.

Turfing out the turf

Synthetics may replace grass and soil surfaces for sporting events. These springy but durable plastic and rubber materials are finding increasing use in sports and recreational facilities. The new Madison Square Garden in New York City is getting a rubber-and-plastic indoor running track. Athletes at this summer's Olympic Games in Mexico City will run on a synthetic resin. Eventually, horse racing tracks, city playgrounds, rooftop recreation areas, walkways into golfers' and ice skaters' locker rooms and baseball dugouts may be made of synthetic materials.

It's toboggan time again

Tobogganing need no longer stop when the snow does. A U.S. firm has come up with a flat plastic slider that swooshes down grass as well as snow and ice. Called the Mini-Boggan, it's made of brightly colored polyethylene sheeting. The new toy is light–it weighs only 1½ lb.–and remains flexible in cold weather. If the kids get tired of it, just roll it up and store it away for a while.

the last word